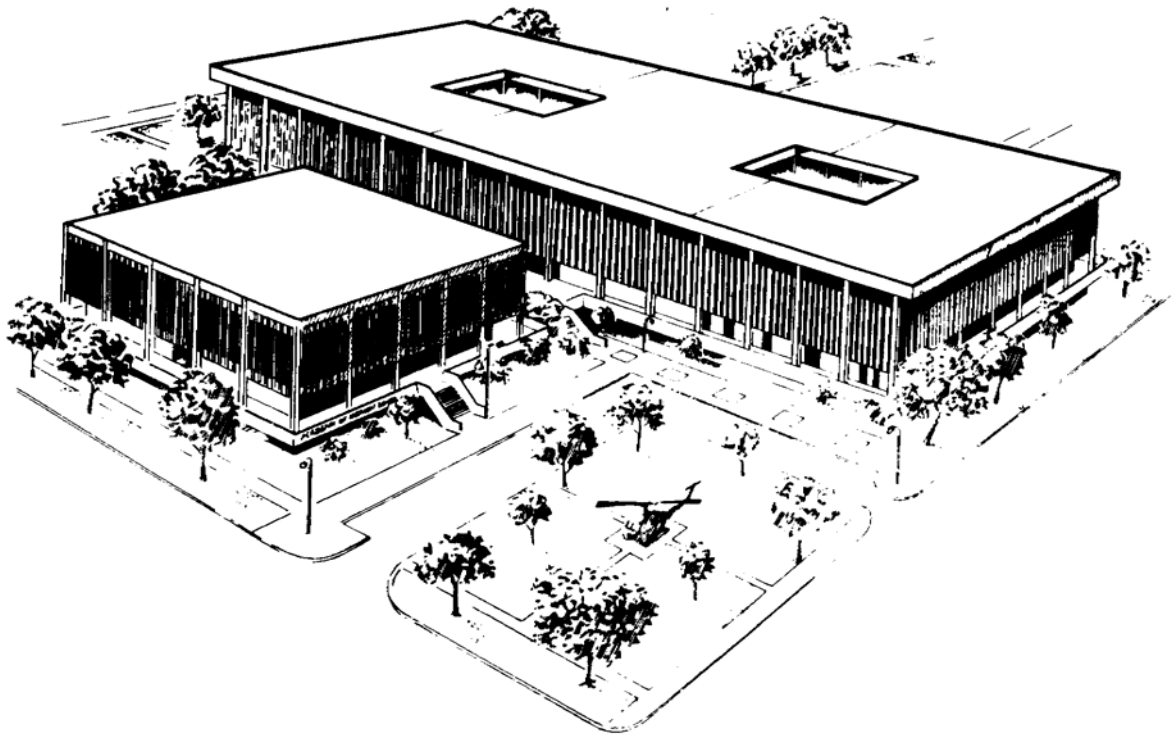


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**U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL  
FORT SAM HOUSTON, TEXAS 78234-6100**

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# **COMMUNICABLE DISEASES AND FIELD SANITATION**

**SUBCOURSE MD0535**

**EDITION 100**

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This subcourse is approved for resident and correspondence course instruction. It reflects the current thought of the Academy of Health Sciences and conforms to printed Department of the Army doctrine as closely as currently possible. Development and progress render such doctrine continuously subject to change.

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**CORRESPONDENCE COURSE OF THE  
U.S. ARMY MEDICAL DEPARTMENT CENTER AND SCHOOL**

**SUBCOURSE MD0535**

**COMMUNICABLE DISEASES AND FIELD SANITATION**

**INTRODUCTION**

Disease has caused far greater losses of manpower during past military operations, than have direct combat deaths. During the Civil War 199,720 soldiers died of diseases compared to 138,154 battlefield deaths. World War II and the Korean, Lebanon, and Vietnam conflicts records show 15,828,940 disease casualties as opposed to 640,254 combat casualties. The control or prevention of disease is the responsibility of each soldier. By practicing proper personal hygiene, food and water sanitation, waste disposal, and control of insects and rodents, disease can be kept to a minimum.

**Subcourse Components:**

This subcourse consists of 5 lessons. The lessons are as follows:

- Lesson 1, Communicable Diseases.
- Lesson 2, Field Water Supply.
- Lesson 3, Field Food Service Sanitation.
- Lesson 4, Field Waste Disposal.
- Lesson 5, Control of Arthropod-Borne and Rodent-Borne Diseases.

**Credit Awarded:**

To receive credit hours, you must be officially enrolled and complete an examination furnished by the Nonresident Instruction Section at Fort Sam Houston, Texas. Upon successful completion of the examination for this subcourse, you will be awarded 14 credit hours.

You can enroll by going to the web site <http://atrrs.army.mil> and enrolling under "Self Development" (School Code 555).

A listing of correspondence courses and subcourses available through the Nonresident Instruction Section is found in Chapter 4 of DA Pamphlet 350-59, Army Correspondence Course Program Catalog. The DA PAM is available at the following website: <http://www.usapa.army.mil/pdffiles/p350-59.pdf>.

## **LESSON ASSIGNMENT**

### **SUBCOURSE MD0535**

Communicable Diseases and Field Sanitation.

### **LESSON 1**

Communicable Diseases.

### **TEXT ASSIGNMENT**

Paragraphs 1-1 through 1-40.

### **LESSON OBJECTIVES**

After completing this lesson, you should be able to:

- 1-1. Identify the five groups of communicable diseases and examples of each group.
- 1-2. Identify the links in the chain of infection and means of breaking the chain.
- 1-3. Identify signs and symptoms, causative agent, reservoir, means of transmission, and control measures for communicable diseases of military importance.

### **SUGGESTION**

After studying the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

# LESSON 1

## COMMUNICABLE DISEASES

### Section I. CYCLE OF INFECTION

#### 1-1. COMMUNICABLE DISEASE

The term "communicable disease" refers to a disease that can be easily transmitted (communicated) from a person or animal with the disease to a person or animal that does not have the disease. Communicable diseases may be transmitted directly (person-to-person contact) or transmitted indirectly (something carries the disease organism from the diseased person to the healthy person). The term "infectious disease" is sometimes used instead of "communicable disease." In this subcourse, both terms will be used to mean the same thing.

#### 1-2. INFECTION

An infection is a condition caused by the entry and multiplication of pathogens (disease-producing microorganisms). Pathogens of one kind or another are present in all areas wherever life exists. They inhabit the air, soil, and water. They are also in waste products, respiratory tracts, alimentary tracts, and on the skins of humans and animals. Some of these organisms can survive for only a few minutes outside the human body while others can survive for years in the environment.

#### 1-3. THE "CYCLE OF INFECTION"

Prevention and control of infectious diseases are of vital importance to the military. Communicable diseases are hazardous to the individual. In addition, communicable diseases result in a great deal of lost manpower. In order for you to understand how communicable diseases can be controlled, you should be familiar with the components of the cycle of infection. The cycle of infection (figure 1-1) is like a chain consisting of six links. For a communicable disease to infect a healthy person, each link of the cycle must be present. Breaking any link in this chain can control the spread of the disease. The six links (causative agent, reservoir, mode of escape, mode of transfer, mode of entry, and susceptible host) are discussed in the following paragraphs.



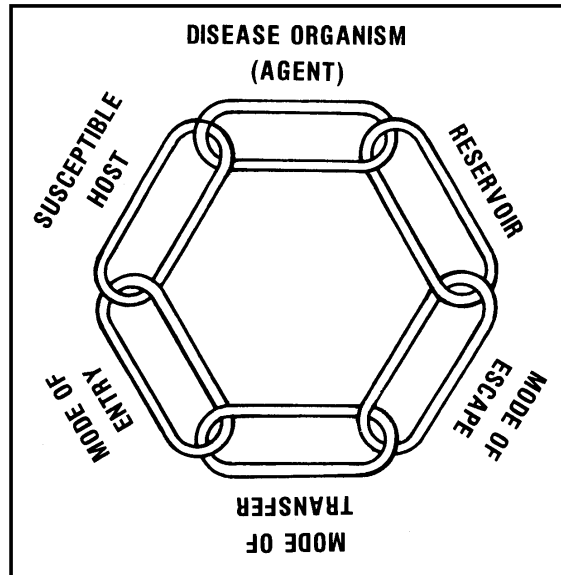


Figure 1-1. The cycle (chain) of infection.

#### 1-4. CAUSATIVE AGENTS

The causative agent is the organism, which produces the disease. Disease-producing organisms include viruses, rickettsiae, protozoa, bacteria, fungi, and parasitic worms.

a. **Viruses.** Viruses are extremely small infectious agents. They are so small that they cannot be seen with a regular microscope. Viruses live inside the cells of the body. When a virus is outside a living cell, it loses its ability to grow and reproduce. It remains in this dormant state until it comes into contact with another living cell which it can invade. An example of a disease caused by viruses is influenza (the "flu"). Different types of influenza viruses produce different types of flu. The common cold, measles, and mumps are also the result of viral infection.

b. **Rickettsiae.** Rickettsiae are larger than viruses. They can be seen with a microscope, but are smaller than most other microscopic organisms such as bacteria. Like viruses, rickettsiae cannot reproduce unless they are inside a living cell. They are commonly found in the digestive system of lice, fleas, ticks, and mites. Examples of diseases caused by rickettsiae include typhus and spotted fever.

c. **Protozoa.** Protozoa are one-celled animals. They are the simplest organisms in the animal kingdom. They are much larger than rickettsiae, but you still need a microscope to see them. Diseases caused by protozoa include malaria and dysentery.

d. **Bacteria.** Bacteria are one-celled plants. Diseases produced by bacteria include streptococcal sore throat (strep throat) and pneumonia.

e. **Fungi.** Fungi are nongreen plants that do not produce their own food. They are parasites; that is, they take their nourishment from other plants or animals on which or in which they live. Disease-producing fungi include molds and yeasts. Diseases include dermatophytosis (ringworm such as "athlete's foot") and several forms of respiratory diseases.

f. **Parasitic Worms.** Parasitic worms are multicellular animal organisms that live within the body. They destroy body tissue and can cause disorders such as dysentery. A major danger is parasitic worms in the blood. These worms can "clog up" a blood vessel. The tissue supplied by the blood vessel may not be able to obtain a sufficient supply of oxygen and nutrients. If this is the case, the tissue will die.

## 1-5. RESERVOIR

The reservoir is the person or animal in or on which the causative agent lives. The reservoir can be any member of the animal kingdom (human, dog, pig, snail, bird, flea, and so forth.). When a person is the reservoir, he is usually classified either as being "ill" or being a "carrier."

a. **III.** A person who is ill is having signs and symptoms caused by the disease. For example, a person who is sneezing, blowing his nose, running a temperature, and not feeling well may be showing signs and symptoms of the common cold.

b. **Carrier.** A person who has a disease, but shows no signs or symptoms of the disease is called a carrier. This person can spread the disease just like the person who is ill. The carrier is actually the more dangerous of the two. Since he shows no signs of being ill, he does not seek medical treatment for the disease nor does he take any special precautions to keep from spreading the disease to others. A famous carrier was "Typhoid Mary." She was a food handler who was a carrier of the disease typhoid. Many people were infected by her until health authorities finally discovered that she was a carrier of the disease.

## 1-6. MODE OF ESCAPE

As long as the disease-producing organism (causative agent) remains within the reservoir (diseased person or animal), it cannot infect another human or animal. The manner in which the organism leaves the reservoir is called the mode of escape. Disease-causing organisms can escape through various routes including the respiratory tract (sneezing, coughing, breathing, talking, and so forth.), gastrointestinal tract (fecal discharges from the bowels), and breaks in the skin (wound drainage, skin lesions, and so forth.). The destruction of the reservoir can also trigger the escape. For example, when meat containing parasitic worms is not properly cooked, the worms may escape from the reservoir (animal flesh) while the meat is being digested.

## 1-7. MODE OF TRANSFER

The mode of transfer (or mode of transmission) refers to how the disease organisms are transported to the healthy person. The mode of transfer is closely associated with the mode of escape. Disease organisms that escape through the respiratory track, for example, may be carried by tiny droplets that are exhaled when the person coughs, sneezes, talks, or just breathes normally. The disease rabies may be transmitted by saliva from the mouth of a diseased animal or person.

a. **Direct Contact.** A communicable disease can be transmitted by the healthy person coming into physical contact with the infected person. This type of transmittal (transfer) is referred to as direct contact. Venereal diseases are spread through direct contact. Another example of direct contact is a disease organism present in a patient's open wound being transferred to a healthy person when that person touches the wound with his fingers.

b. **Indirect Contact.** Communicable diseases can also be transmitted even if there is no direct physical contact between the infected person and the healthy person. In this method of transmittal, called indirect contact, something carries the disease organism from the diseased person to the healthy person.

(1) Airborne transfer. A common example of indirect contact concerns cold viruses. When the infected person sneezes, tiny droplets containing cold viruses are expelled into the air. These droplets will float on the air for a considerable time. If a healthy person breathes in these droplets, he will become infected.

(2) Food contamination. An example of a communicable disease transmitted by food contamination is typhoid. The typhoid organism on a person's hand will contaminate the food that the person touches. When another person eats the contaminated food, that person becomes infected.

(3) Insects. Some disease organisms are transmitted by insects. Malaria, for example, is a disease transmitted by a certain type of mosquito. When this type of mosquito "bites" a person infected with malaria, the insect may take in disease organisms along with the person's blood. When the mosquito bites another person, some of these disease organisms may escape into the bite wound and infect that person.

(4) Fomites. Fomites are objects that can carry disease organisms. Examples of fomites include surgical instruments, bed linen, eating utensils, drinking glasses, towels, and hairbrushes. When an object comes into contact with an infected person, some of the disease organisms may be left on the object. If another person uses the object before it is properly cleaned, the disease organisms may enter his body.

## 1-8. MODE OF ENTRY

The mode of entry refers to the avenue by which the disease organism enters the body of the healthy person (host). It is closely associated with the mode of escape and the mode of transfer. Disease organisms that escape on droplets when a person sneezes, for example, enter the body of the healthy person when the person inhales air containing some of these droplets. Malaria organisms escape when the mosquito punctures the infected person's skin, travels in the mosquito's digestive system, and enters the healthy person when the mosquito punctures that person's skin.

## 1-9. SUSCEPTIBLE HOST

The susceptible host is the person who does not have the disease but who can "catch" the disease if exposed to the disease organism. This person then becomes a reservoir and, in turn, provides the means by which new hosts can be infected.

## Section II. BREAKING THE CYCLE OF INFECTION

### 1-10. BREAKING THE CHAIN

Paragraph 1-3 compared the cycle of infection to a chain with six links. Like a chain, the cycle of infection can be broken if any one of the six links are broken. In the following paragraphs, we will discuss how the spread of communicable diseases can be controlled by attacking these links.

### 1-11. BREAKING THE CAUSATIVE AGENT LINK

a. **Antibiotics.** One way of breaking the chain is by destroying the disease organisms (causative agent) that are in the body. This is done through the use of antibiotics. Antibiotics are drugs produced from fungi and bacteria. They attack certain disease-producing organisms, but do not attack the person's body. The death rates from many diseases (such as pneumonia, meningitis, scarlet fever, and syphilis) have been drastically reduced through the use of antibiotics such as penicillin, streptomycin, and ampicillin.

(1) Penicillin. Penicillin is an antibiotic produced from a mold of the genus *Penicillium* and was the first antibiotic. It was discovered by the British bacteriologist Alexander Fleming in 1929, but was extremely hard to produce. The first successful medical use of penicillin occurred in 1941. In 1943, a breakthrough allowed penicillin to be produced in large amounts.

(2) Streptomycin. In 1944, an American bacteriologist isolated the antibiotic streptomycin from another type of fungus. Since then, several other antibiotics have been discovered and used in treating diseases.

b. **Extinction.** If the organism that causes the disease can be eliminated, then the disease itself will be eliminated. This process has been successfully used with the

smallpox virus. Smallpox was a communicable disease spread by droplets expelled through the respiratory track. For centuries, it was one of the world's most feared diseases and was responsible for millions of deaths. Smallpox epidemics were disastrous. Armies sometimes suffered more deaths from smallpox than from actual combat. Although only about 20 percent of the victims died, many others were left blind and/or permanently scarred. A vaccine against smallpox was developed by the English physician Edward Jenner in 1796. Since the disease only affected humans, its spread could be controlled by worldwide immunization and quarantine procedures. Finally, in 1979, the World Health Organization announced that smallpox had been eliminated. Since then, smallpox immunization has ceased throughout the world.

## **1-12. BREAKING THE RESERVOIR LINK**

Isolation, quarantine, and medical surveillance are methods of controlling the person with the disease. If the person can be separated from people who do not have the disease, the spread of the disease is limited. This effort is even more successful when fomites (clothing, bedding, and so forth) which have been contaminated by the person are destroyed or cleaned in such a way that the disease organisms are killed.

a. **Isolation.** Isolation is a procedure whereby the infected person is separated from other individuals. Usually, this separation is accomplished by admitting the person to the isolation ward of a hospital. In an isolation ward, extreme care is taken to prevent any disease organisms from escaping and infecting other people.

b. **Quarantine.** Quarantine is a limitation placed on the freedom to travel. People who have been exposed to a disease may be restricted to a house or to a limited geographic area so as to not come into contact with people who have not been exposed to the disease. Animals coming into the United States (US) from a foreign country are quarantined and observed for a given period of time. If the animal shows no signs of communicable disease during the quarantine period, it is released to its owners.

c. **Medical Surveillance.** Quarantine may not be practicable where large numbers of people are involved or it is simply not possible to keep the people who have been exposed to the disease together in a single location. In such cases, individuals who have been exposed to the disease are checked on a regular basis, usually daily. If a person shows signs and symptoms of the disease, the appropriate measures are taken. If, after a given time, the person has not developed signs and symptoms of the disease, the medical surveillance is stopped.

## **1-13. BREAKING THE MODE OF ESCAPE LINK**

Many disease-producing organisms can be controlled as they leave the reservoir through the respiratory tract, gastrointestinal tract, or breaks in the skin.

a. **Respiratory Tract.** Placing a handkerchief over your mouth and nose when you cough or sneeze helps to prevent the spread of the disease. Wearing a mask and

not talking directly into a person's face are other measures used to control the spread of disease organisms that escape through the respiratory tract.

b. **Gastrointestinal Tract.** Disease-producing organisms that use the gastrointestinal tract as a mode of escape usually leave the body in feces. These diseases can be controlled through the use of proper sanitation and hygiene. An adequate handwash after using the latrine is very important in controlling these diseases.

c. **Skin.** Disease-producing organisms that escape through wounds can be controlled through the use of dressings that absorb the drainage that carries the disease organisms. Good personal hygiene will also help to prevent the spread of disease.

#### 1-14. BREAKING THE MODE OF TRANSFER LINK

a. **Direct Contact.** Diseases that are spread by direct contact can be controlled by preventing the contact from occurring. Wearing surgical gloves when examining a patient's wounds can prevent disease organisms from the wound from entering your body and prevent any disease organisms that may be present on your hands from infecting the patient's wounds. Avoidance of sexual intercourse with a person infected with venereal disease is another example of controlling the spread of communicable disease.

b. **Indirect Contact.**

(1) Arthropod-borne diseases. Communicable diseases that are transmitted by certain arthropods can be controlled by eliminating the arthropod that carries the disease. One of the major methods of controlling malaria, for example, is the elimination of the *Anopheles* mosquito in the area.

(2) Food contamination. Diseases that are spread through contamination of food and water can be controlled by destroying the contaminated food item, by not drinking contaminated water, or by making the food or water safe for consumption. Most disease-producing organisms present in raw foods can be destroyed by properly cooking the food item. (Cooking, of course, will not kill organisms that come into contact with the food after the food has been cooked and is ready to be served.) Water can usually be made safe to drink using the procedures given in Lesson 2.

(3) Fomites. Disease spread by fomites can be controlled by destroying the disease-carrying article, by destroying the disease-producing organisms on the article, or by preventing the article from coming into contact with another person. Dressings and bandages may be removed from the wound by a person using surgical gloves, placed in a special container for contaminated items, and burned. Eating utensils and surgical instruments that come into contact with the person or which come into contact with another article that has been contaminated by the person can be sterilized.

Brushes and other personal hygiene items used by the infected person should be identified and not used by anyone else. When the person recovers, the articles are usually destroyed.

### **1-15. BREAKING THE MODE OF ENTRY LINK**

Communicable diseases can be prevented if the organism that causes the disease cannot enter the body of the healthy person. Wearing a mask in the hospital helps to protect you from breathing in droplets in the air that may be carrying disease organisms. Wearing surgical gloves when you touch the patient's wound or items that have been in contact with the patient (bandages, dressings, syringes, and so forth) helps to prevent the organisms from entering your body. Be careful when disposing of the body excretions of a patient. Do not come into direct contact with the excretions or with articles that have been contaminated with the excretions (used bedpans, soiled linen, and so forth). Since the skin is a major barrier to disease-causing organisms, any break in your skin is a potential site of entry. Proper personal hygiene, especially proper handwashing, will help to remove any disease-producing organisms that are on your skin.

### **1-16. BREAKING THE SUSCEPTIBLE HOST LINK**

A susceptible person is one who has little resistance against the disease-producing organism and is likely to become infected if the disease-producing organism enters his body. An adult who has good general health is less likely to become infected than a person who is chronically ill. In addition, some people have immunity to certain diseases.

a. **Immunity.** Immunity is the ability of an individual to resist or overcome the invasion of disease organisms. Most newborn babies have a high level of immunity to a number of diseases that is derived from their mothers. This immunity is only temporary and is lost within a few months after birth. The immunity that adults possess is usually acquired after birth in one of the following ways.

(1) Natural immunity. A person can acquire immunity to certain diseases by becoming infected with the organisms that cause those diseases. This infection may cause the person to become ill or it may be so mild that the person does not know that he has the disease. In either instance, the body may build up enough resistance to protect the individual from contracting the disease a second time. This protection develops only with certain infections such as measles, mumps, diphtheria, and chickenpox. There are many diseases such as pneumonia, tetanus, and gonorrhea against which the body does not produce effective or lasting immunity.

(2) Artificial immunity. In the case of some infections that result in naturally acquired immunity, it is possible to stimulate this immunity by injecting a vaccine (weakened or killed organisms or their products) into the person's body. This process is called "vaccination" or "immunization." In order to obtain a protecting level of immunity,

it may be necessary to give several doses of the vaccine at intervals of a few weeks or a few months. This is called the initial series. Therefore, because the immunity is gradually lost, it may be necessary to have "booster" doses at periodic intervals in order to restore an adequate level of resistance. At present, effective artificial immunization is available against a limited number of diseases including typhoid, tetanus, diphtheria, cholera, epidemic typhus, plague, yellow fever, German measles, poliomyelitis, and influenza. Artificial immunization, however, does not provide absolute protection against the specific disease nor does it protect against other diseases. Consequently, protective measures such as personal hygiene and sanitation must never be relaxed because a person has been "immunized."

b. **General Good Health.** The body fights against disease-producing organisms. If successful, the disease-producing organisms may be destroyed before the person becomes ill. Some individuals are more susceptible to diseases than others. These include young children (their immune defenses have not fully developed), the aged (their immune defenses have diminished), people on inadequate diets, people who are ill or have chronic diseases such as diabetes, people receiving certain types of medical therapy such as cancer patients receiving chemotherapy, people suffering from shock, and people who have open wounds (especially burn wounds). Separating high-risk persons from people with known infections and people who have been exposed to certain diseases will help to prevent the spread of communicable diseases. Providing nutritional supplements will help people who are malnourished or undernourished to resist disease.

### **Section III. RESPIRATORY DISEASES**

#### **1-17. CLASSIFICATION OF COMMUNICABLE DISEASES**

Communicable diseases may be classified into five general groups: respiratory, intestinal, arthropod-borne, venereal, and miscellaneous. These groups differ in the manner in which the diseases are transmitted and controlled in addition to differing in their effects. Respiratory communicable diseases are discussed in this section. The other four groups of communicable diseases are discussed in Sections IV through VII. Each section also discusses how that type of disease is spread and methods for preventing the spread of that type of disease.

#### **1-18. PRINCIPAL RESPIRATORY DISEASES**

Respiratory infections are the greatest cause of sickness in the Army. They occur the year round, but they are most common during winter and spring. While all troops are affected, the highest rates of infection occur among unseasoned troops. The principal respiratory among military populations are the common cold, adenovirus, German measles, influenza, meningitis, and streptococcal sore throat.

a. **Common Cold.** The common cold is probably the most frequently occurring respiratory disease. It is caused by any of a large number of viruses. The symptoms of



the common cold--familiar to everyone--consist of coughing, sneezing, sore throat, running nose and eyes, and a general ill feeling. It is usually self-limited, running its course in two to seven days.

b. **Adenovirus.** Many of the respiratory diseases acquired by recruits are caused by adenoviruses. These infections are characterized by fever and one or more symptoms such as chills, headache, general aching, and respiratory signs similar to a cold or pneumonia. Symptoms and signs usually disappear in two to three days; however, complications may occur from bacterial infections. Adenovirus vaccine may be used to help control major outbreaks when authorized by The Surgeon General.

c. **German Measles (Rubella).** German measles is caused by a virus. It is primarily a mild childhood disease and is characterized by a low-grade fever, rash, headache, and sometimes by symptoms resembling the common cold. Though not a serious illness, rubella is of concern to the Army because of its epidemic nature. It is also a disease of considerable importance to all young adults since women contracting the disease during pregnancy may give birth to children with congenital defects. Immunization with rubella vaccine is recommended for all basic trainees.

d. **Influenza (Flu).** Influenza is a viral disease with symptoms similar to those of the common cold accompanied by headache, general aching, and usually a severe and protracted cough. While generally a self-limited disease lasting two to seven days, influenza has often occurred in epidemic form and has caused a large number of deaths. Several types of influenza virus are recognized and vaccines have been developed for protection against these types of influenza. Current Army practice is to administer annual influenza immunization to all active duty personnel.

e. **Streptococcal Sore Throat.** This type of infection is caused by the bacteria *Streptococcus pyogenes*, of which there are about 60 different types. Symptoms include fever, sore throat, and tonsillitis with varying degrees of pus formation. It is frequently extremely painful and can lead to severe complications. No immunizing agent is available and the administration of antibiotics is the normal method of treatment.

f. **Meningococcal (Epidemic Cerebrospinal) Meningitis.** This serious, often fatal, disease is caused by the bacteria *Neisseria meningitidis*. Signs and symptoms may include any or all of the following: fever, intense headache, nausea, and frequently a petechial rash and/or stiff neck. (A petechia is a pinpoint, nonraised, perfectly round, purplish-red spot caused by bleeding under or between the skin layers.) The disease produces an inflammation of the meninges (the membrane surrounding the brain and the spinal cord). This disease can result in damage to the brain, contractions of the spinal cord, and/or death. The possibility of an outbreak of meningococcal meningitis is most likely to occur in training centers where trainees receive their initial training. A vaccine against meningococcal meningitis is available for immunizing recruits when so authorized by The Surgeon General.

## 1-19. METHODS OF TRANSMISSION OF RESPIRATORY DISEASES

Respiratory diseases are transmitted by secretions of the respiratory tract, particularly through close association with infected persons. The disease-producing organisms leave the body of the ill person or the carrier in small droplets of moisture during coughing, sneezing, or talking, and may be inhaled directly by other persons (droplet infection). Some of the smaller droplets lose their moisture by evaporation and become solid masses of dried germs. Being very light, these germ particles float in the air for long periods of time. If inhaled by a susceptible person, they can cause disease (airborne infection). Harmful organisms from the mouth or nose may also contaminate hands, food, eating and drinking utensils, towels, and other articles by which the disease-producing organisms may be carried to the mouths of others.

## 1-20. RESPIRATORY DISEASE CONTROL MEASURES

The principal difficulty in the prevention and control of respiratory disease lies in the fact that most individuals are susceptible to them. Another problem is that an infected person is usually transmitting the disease to others before he has any symptoms or realizes that he is infectious. There are numerous measures used to control or reduce these diseases. When used properly, they are quite effective. Some of these measures are listed below.

a. **Isolation of Cases.** Unless a medical officer advises otherwise, known cases should be separated from healthy persons. Serious cases should be hospitalized.

b. **Quarantine and Surveillance of Contacts.** These measures, which are described in paragraph 1-12, may be used to control serious outbreaks of respiratory disease.

c. **Immunization.** Immunization is an excellent preventive measure for those diseases for which immunizations are available. In some cases, immunizations are given only when a major outbreak of the disease is likely to occur.

d. **Avoidance of Overcrowding.** Overcrowding is an important factor in the spread of respiratory infections. Overcrowding is more likely to occur in barracks during basic combat training than in the field. During basic combat training, each trainee is to have 72 square feet of floor space in the barracks, exclusive of stairs, halls, and latrines. The recommended space for all troops is also 72 square feet, but this may not always be possible. The minimum is not to be less than 55 square feet except for temporary peak-load periods during which a minimum of 40 square feet per man is permissible. As the space per person is reduced, however, the incidence of respiratory diseases can be expected to increase.

(1) If beds are less than five feet apart, individuals should sleep head-to-foot. The purpose of this arrangement is to put as much distance as possible between the respiratory tracts of persons sleeping in adjacent bunks.

(2) When respiratory diseases are present and crowding cannot be avoided, the individual cubicle system (figure 1-2) should be used. Bed cubicles are made by converting each bed space into its own compartment with the use of screens. A common method is to attach a pole to the head of the bed and rig a shelter half to extend above the head of the bed with the lower edge folded under the mattress. Blankets and sheets may be used for this purpose instead of the shelter half.

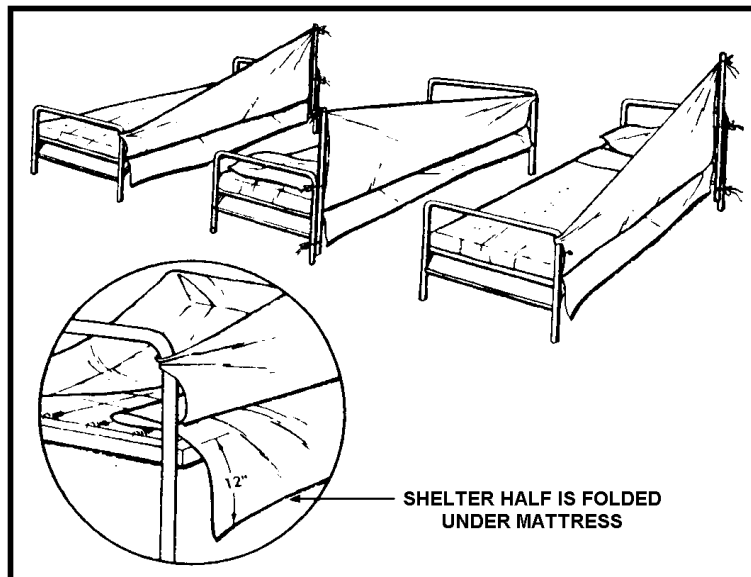


Figure 1-2. Constructing cubicles in squad room.

e. **Ventilation.** Good ventilation, either by natural or by mechanical means, has a double objective--health and comfort. Proper ventilation will dilute the number of organisms in the immediate atmosphere and thus reduce the number that may be inhaled.

f. **Dust Control.** Disease-producing organisms that have been expelled from the nose and throat can cling to dust particles and may transmit infection by the airborne route unless proper dust control measures are carried out. To avoid raising dust, dry sweeping should be forbidden. Sweeping should be done using wet sawdust or a sweeping compound. Mopping can be substituted for sweeping. Oiling of unfinished wood floors is an excellent means of dust control.

g. **Personal Hygiene.** Each soldier is responsible for protecting his own health, as well as the health of his fellow soldiers, by practicing good habits of personal hygiene. You should wash your hands frequently with soap and water. When coughing or sneezing, you should cover your nose and mouth. You should not use drinking cups, canteens, towels, or any personal items belonging to other people. During the acute stage of a cold, you should avoid close contact with other people.

h. **Food Service.** Dishes, cooking utensils, and food service equipment must be cleaned and disinfected after each meal. Food handlers must be strictly supervised

and trained in sanitary food-handling practices since they could infect others through the food they prepare or serve. Food handlers should be inspected by the supervisor at the beginning of each shift. Individuals who are ill are to be sent to the clinic and are to return to food-handling duties only when they are no longer infectious.

i. **Prophylaxis.** Inoculations against certain diseases are given as a prophylactic (preventive) measure.

## Section IV. INTESTINAL DISEASES

### 1-21. GENERAL

Intestinal diseases are usually caused by the contamination of food and water with human feces or urine; therefore, they are sometimes called "filth diseases." They result chiefly from poor hygiene and poor sanitation. Both of these factors can be controlled by good common-sense practices of cleanliness. Persons who keep their hands and bodies clean and who consume only food and water that have been properly prepared and treated seldom develop these diseases. The problem of intestinal diseases exists in most parts of the world and requires constant vigilance, especially in areas where native sanitation is primitive. These diseases may affect large numbers of individuals at the same time and cause a serious loss of fighting strength. Two terms commonly associated with communicable intestinal diseases are diarrhea and dysentery.

a. **Diarrhea.** Diarrhea refers to a fecal discharge which is primarily liquid and which occurs more frequently than normal.

b. **Dysentery.** Dysentery is an intestinal disorder characterized by inflammation of the intestines (especially the colon), pain in the abdominal region, tenesmus (ineffectual and painful straining when trying to have a bowel movement or when trying to urinate), and stools containing blood and mucus.

### 1-22. PRINCIPAL INTESTINAL DISEASES

Sometimes the terms "GI's," "abdominal cramps," or "diarrhea" are used to describe intestinal illnesses in general. Some of the communicable intestinal diseases of military importance are bacillary dysentery, cholera, bacterial food poisoning, and infectious hepatitis.

a. **Bacillary Dysentery (Shigellosis).** This disease is one cause of diarrhea among troops. It is caused by bacteria of the genus *Shigella*. Symptoms vary from mild diarrhea to severe dysentery with fever, vomiting, cramps, and stools containing blood, pus, and mucus. It occurs worldwide and outbreaks are common under conditions of crowding and poor sanitation. It is seldom fatal except for the very young, the very old, and patients who have been weakened by other disease or injuries.

b. **Cholera.** Cholera is a serious disease caused by the bacteria *Vibria cholerae*. Its symptoms include sudden onset, profuse watery stools, vomiting, rapid dehydration, and circulatory collapse. Death may occur within a few hours of onset. The death rate may exceed 50 percent in untreated cases, but is usually about one percent in treated cases. While cholera has been virtually absent from the Western Hemisphere since 1911, it still exists in many parts of Asia, Africa, the Middle East, and Eastern Europe. An effective vaccine for cholera is available and military personnel and their dependents traveling to areas where cholera is present are required to be immunized.

c. **Bacterial Food Poisoning.** Bacterial food poisoning results from a combination of three conditions: contamination of food by bacteria, sufficient time for the bacteria to reproduce, and a temperature favorable to bacterial growth. The two kinds of bacterial food poisoning of primary military importance are salmonellosis and staphylococcal food poisoning.

(1) Salmonellosis. Salmonellosis is actually an infection rather than a poisoning. It is caused by *Salmonella* bacteria in food. Symptoms include sudden onset of abdominal pain, diarrhea, nausea, and vomiting. Fever and dehydration are usually present. Deaths are uncommon except in the very young, the very old, and persons weakened from other causes.

(2) Staphylococcal food poisoning. Staphylococcal food poisoning is caused by eating food containing a toxin (poison) produced by staphylococci bacteria multiplying in food. Symptoms appear from one to six hours after eating food containing the poison. Symptoms include severe nausea, cramps, vomiting, diarrhea, and prostration. Deaths are rare and the duration of the illness is usually not longer than a day or two.

d. **Infectious Hepatitis.** Infectious hepatitis (hepatitis A) is a viral disease characterized by fever, nausea, loss of appetite, abdominal discomfort, and a general ill feeling. These signs and symptoms are followed within a few days by jaundice, a condition characterized by a yellowish coloration of the skin. It varies from a mild illness lasting one or two weeks to a severely disabling disease lasting several months. A long period of convalescence is usually required. This disease is not to be confused with serum hepatitis (hepatitis B), a similar but more severe disease transmitted by contaminated hypodermic needles, surgical instruments, blood transfusions, and so forth. (para 1-38).

## 1-23. METHODS OF TRANSMISSION OF INTESTINAL DISEASES

The most common means of transmission of intestinal diseases are often referred to as the "5 F's": feces, fingers, flies, food, and fluids. The principal source of infection is the feces of man; but poultry, eggs, rodents, and fish may also be involved. Infection may be spread in any of the following ways.

a. **Food Handlers.** Food may be contaminated by infected food handlers who are careless or dirty in their personal habits.

b. **Flies.** Houseflies that come into contact with human or animal feces may "pick up" disease-producing organisms on their feet or body. These flies then contaminate foods with which they come into contact in the dining hall or the kitchen.

c. **Self-Contamination.** A person who does not wash his hands adequately after using the latrine may have fingers contaminated with feces. Disease-producing organisms can enter his mouth when he touches his mouth area with his fingers or when he eats food, which has come into contact with his fingers.

d. **Improper Cooking.** Carcasses of beef, pork, chickens, and turkeys may be contaminated by disease-producing organisms (particularly *Salmonella*) from the intestines of these animals while they are being dressed. Eggs, especially duck eggs, can become contaminated by fowl feces in the nest. Improper cooking (not getting the food items hot enough to kill the organisms or not cooking the food long enough to kill the organisms) allows the disease-producing organisms to survive and infect those who eat the food.

e. **Water.** Natural sources of water, such as lakes and streams, often are polluted by drainage from latrines and sewers. Springs and wells may be similarly contaminated. In the field, careless disposal of human waste is a frequent source of danger. Such waste material may drain into a nearby water source or furnish a breeding place for flies.

f. **Rodents.** Rodents frequently urinate or defecate on foods to which they have access and contaminate the foods with disease organisms.

## 1-24. INTESTINAL DISEASE CONTROL MEASURES

a. **Responsibility.** Commanders at every level, as well as platoon leaders and noncommissioned officers, are responsible for enforcing sanitary regulations and taking all other necessary precautions against the spread of intestinal diseases. Each individual soldier is responsible for personal hygiene and taking proper preventive measures.

b. **Controlling Transmission.** The most effective method of preventing intestinal diseases is to control the source and agencies which transmit them--food handlers, human waste, flies, food, and water. Continuing and unrelaxing attention to the following measures are required.

(1) Good food service sanitation, including the careful selection, education, and daily inspection of food handlers.

(2) Personal cleanliness, particularly washing the hands after each visit to the latrine and before eating or otherwise handling foods.

(3) Careful selection, inspection, and protection of food supplies.

(4) Strict supervision of the handling, preparing, cooking, and storing of foods to include proper temperature control.

(5) Sanitary disposal of human and other wastes.

(6) Effective fly and rodent control and the protection of foods against fly and rodent contamination.

(7) Purification and protection of the water supply.

(NOTE: All water is to be considered dangerous unless it has been properly treated. This is also true of ice from questionable sources.)

(8) Avoidance of unapproved food and water sources.

c. **Immunization.** All military personnel are routinely immunized against typhoid fever. Cholera immunization is required in geographical areas where the disease is prevalent. Gamma globulin is sometimes administered to high-risk persons as temporary protection against infectious hepatitis.

d. **Reporting and Investigating Outbreaks.** Cases of intestinal diseases should be reported to the unit medical officer as soon as detected so that he may take the necessary steps to investigate the cause and avert a possible epidemic.

## **Section V. ARTHROPOD-BORNE DISEASE**

### **1-25. GENERAL**

The term "arthropod" includes both true insects such as mosquitoes, wasps, bees, flies, fleas, and lice and arachnids such as ticks, mites, chiggers, spiders, and scorpions. Arthropods harm the health of humans by transmitting disease, by injecting venom (stinging), by feeding on the host (blood-sucking), and by being an annoyance (interfering with sleep or work). The principal arthropod-borne diseases include some of the most common and most serious epidemics of mankind such as malaria, plague, yellow fever, and typhus. These diseases can occur in most parts of the world, but are more common in tropical regions. Uncontrolled, they can cripple large military forces and have done so. Arthropods, diseases that they transmit, and control measures are discussed in greater detail in Lesson 5.

## 1-26. METHODS OF TRANSMISSION OF ARTHROPOD-BORNE DISEASES

Disease agents are transmitted by arthropods in two general methods--mechanical transmission and biological transmission.

a. **Mechanical Transmission.** In mechanical transmission, the disease-producing organisms are picked up on the body or the legs of the arthropod and then deposited on food, drink, or open sores. An example of mechanical transmission is the transfer of typhoid or dysentery organisms from fecal matter.

b. **Biological Transmission.** In biological transmission, the arthropod becomes infected by biting a diseased human or animal. The organism develops in the body of the arthropod and is later transmitted to a susceptible individual, usually by a bite as in the case of malaria. A less common type of contamination occurs when the broken or chafed skin of a susceptible individual comes into contact with the body juices or feces of the arthropod as in the case of louse-borne typhus.

## 1-27. ARTHROPOD-BORNE DISEASE CONTROL MEASURES

a. **Reservoir.** Human sources of infection are controlled through personal hygiene, surveillance, isolation, quarantine, and treatment. Animal reservoirs are normally controlled by restricting their access to human habitation and/or by extermination.

b. **Transmitting Arthropods.** Diseases can be controlled by killing the flies, mosquitoes, and other arthropods that transmit disease and by destroying their breeding places.

c. **Sanitation.** Proper sanitation will prevent flies and other arthropods from coming into contact with human wastes.

d. **Susceptible Persons.** Susceptible persons are protected from arthropod-borne diseases primarily through individual protective measures (para 1-28) and immunizations. Vaccines are available for immunizing against plague, yellow fever, and epidemic typhus; however, they are only administered to personnel who are assigned to geographical areas where these diseases are prevalent.

## 1-28. INDIVIDUAL PROTECTIVE MEASURES

Individual protective measures are to be used by each soldier. Since these measures are essential for the effective prevention and control of malaria, they are frequently called "malaria discipline" even though they are also necessary for the prevention and control of most other arthropod-borne diseases. The closer an individual gets to combat, the more important it is that he know how to apply individual protective measures. Instruction given in training periods should be repeated when necessary and applied on field maneuvers. Commanders must strictly enforce



individual measures for insect and malaria control. A man in a foxhole or on the frontline can protect himself reasonably well if he knows how to avoid infection and realizes the importance of doing so.

a. **Clothing.** The combat uniform, when worn loosely with the trousers tucked into the boots without blousing rubbers and with the sleeves down and buttoned, provides a large measure of protection to the soldier. A mosquito can bite through most clothing only when it is worn tightly against the skin. Wearing the uniform in this way also makes it more difficult for mites and ticks to get under the clothing. It may be necessary to wear headnets and gloves. Headnets afford excellent protection for the face and neck. Headnets are particularly useful in areas where mosquitoes and biting flies are abundant, such as in the Arctic during the summer. Wearing shorts as an outer garment during the hours from dusk to dawn should be prohibited and no person should be allowed outdoors without wearing a shirt during this period. This type of control can be effective only by strict discipline and frequent inspection.

b. **Clothing Repellent, M-1960.** Uniforms impregnated with clothing repellent provide additional protection against arthropods such as ticks and mites. These arthropods crawl into clothing openings in order to gain access to the body. Since the repellent is mildly irritating to the skin and sometimes causes inflammation, it is not used routinely nor is it applied to underwear and socks. The medical authority normally authorizes the use of M-1960 clothing repellent when troops must conduct operations in areas infested with mites and ticks.

c. **Insect Repellent for Personal Application.** Individual insect repellent (DEET) is available in a two-ounce plastic bottle. DEET is applied to the hands and then rubbed on the face and other exposed skin areas. DEET provides good protection against disease-carrying mosquitoes and other insects for two to four hours, provided the repellent is not washed off or diluted with perspiration. More frequent applications may be necessary for soldiers engaged in strenuous activity. DEET can also serve effectively as a repellent on clothing. The DEET should be applied around clothing openings such as the collar, waist, sleeve cuffs, and boot tops and applied to clothing which fits over the body snugly such as over the shoulder blades and over the buttocks.

d. **Insect Bar.** The insect bar (bednet) shown in figure 1-3 is a necessity even in a screened billet. This device is composed of two T-rods and a net. One T-rod is attached to each end of the bed. When a person is not sleeping on a bed, the T-rods are stuck into the ground at the head and the feet. The net is suspended from, not draped over, the T-rod and tucked securely under the mattress or sleeping bag except for an entrance port. The net is then inspected for holes and repaired as needed. After crawling through the entrance port, the occupant tucks the remainder of the net under the mattress and sprays insecticide (paragraph 1-28e below). He must take care not to come in contact with the net since arthropods can bite through it. The insect bar should always be carried as personal equipment by all troops entering a malarious area, even in forward combat areas. There are cases in which 20 percent of the troops have become ill with malaria as the result of being exposed to mosquitoes for one night without the protection of insect bars.

e. **Insecticide Dispenser.** The aerosol insecticide dispenser (figure 1-4) provides quick, effective "knock-down" of mosquitoes, flies, gnats, and other flying insects. Its action is immediate, but of very short duration and provides virtually no residual effect. After getting inside an insect bar, the occupant releases the insecticide from the dispenser for approximately five seconds. This kills any insects that may have gained access under the insect bar. The spray is also used in other enclosed spaces such as tents, bomb shelters, and foxholes.

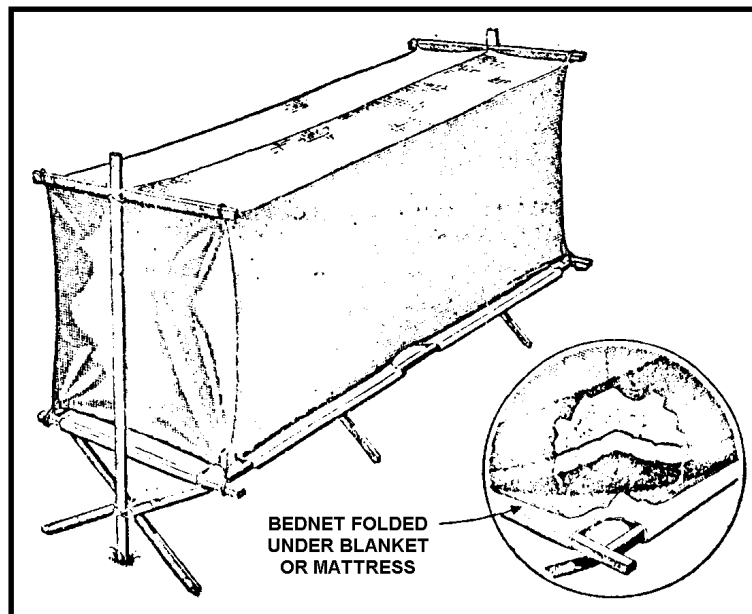


Figure 1-3. Insect bar on the folding cot.

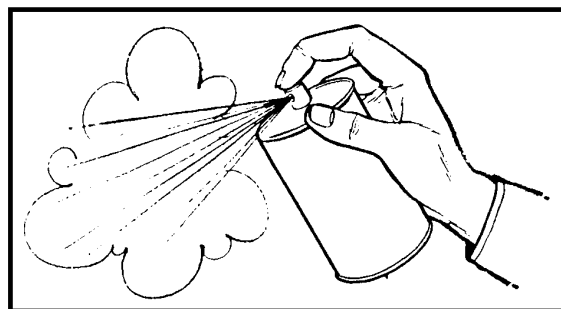


Figure 1-4. Aerosol insecticide dispenser, 12-ounce.

f. **Louse Powder.** Lindane powder sprinkled into the clothing will provide protection against such small arthropods as lice, fleas, ticks, mites, and bedbugs. Lindane powder in the two-ounce sifter can is issued to soldiers for individual use. If possible, the individual should take a bath before putting on the treated clothing. The clothing should be dusted as follows:

- (1) Apply the powder inside the hat.

(2) Spread the coat, with sleeves turned inside out, on a table so that all of the inside can be seen. Powder the inside, taking special care to apply the powder along the shoulder, armpit, and arm seams.

(3) Turn the trousers inside out and lay them with the seat uppermost on top of the coat. Powder all seams, particularly at the crotch and down both legs.

(4) Spread and powder the shirt in the same way as the coat (paragraph (2) above).

(5) Turn the underwear inside out and powder it thoroughly, again giving special attention to the seams.

(6) Fold the entire pile of clothing together and pound it several times to fluff the powder.

(7) Repeat the procedure before putting on each change of clean clothing. The shoes are not ordinarily powdered.

**g. Individual Control Procedure for Head and Crab Lice.**

(1) Using the two-ounce sifter can of lindane powder (paragraph 1-28f above), dust the head and hairy portions of the body.

(2) Do not bathe or wash the hair for 24 hours. (This gives the insecticide time to kill the lice.)

(3) One week from the initial application, apply the insecticide powder again to kill lice that may have hatched in the meantime. Do not bathe and shampoo for 24 hours after the powder has been applied.

(4) At the end of 10 days, examine the head and hairy parts of the body closely to be sure that no living lice are present. If the hair is cut short, lice can be seen more easily. Short hair is also easier to powder effectively. Shorn hair should be collected and burned.

**h. Delousing Extra Clothing and Bedding.** Although killing the lice found on a person's body and on the clothes he is wearing will usually solve the problem, extra clothing and bedding can be infested and cause reinfestations.

(1) When delousing extra clothing and bedding with a hand duster, place the delivery tube between the layers of clothing in order to speed the job and avoid wasting powder. If mattress covers are not in use, place a blanket over the mattress and apply the powder between the two items, taking care to reach the sides and seams. Blankets are deloused by spreading one on top of another and dusting between every two of them or by folding each blanket once and dusting between the two layers. The

folded blanket may be placed on a flat surface, hung over a line, or held by two other persons. When the whole job is finished, each pile of blankets should be pounded several times in order to spread the powder and work it into the seams and patches.

(2) When a hand duster is not available, apply the powder with a sifter can. As each blanket is spread, the powder is shaken onto it. The surface of one blanket will then spread the powder onto the undersurface of the next. After a number of blankets have been dusted, pound or fluff them lightly to distribute the powder evenly. Canvas packs, duffle bags, boxes, footlockers, and similar items may also need dusting.

## **Section VI. VENEREAL DISEASES**

### **1-29. GENERAL**

Historically, venereal disease (VD) has been a major health problem of both civilian and military communities. Unlike most other communicable diseases, VD has flourished for many years simply because a false modesty has kept people from facing the facts. Only a few years have passed since it was considered impolite to use the words "syphilis," "gonorrhea," and "venereal disease" in public. So great was the shame attached to these diseases that many doctors often hesitated to treat them, fearing possible injury to their professional prestige. Regardless of this false sense of pride, venereal diseases continued to infect all classes of society. No one was immune from these infections that killed some and ruined the lives of thousands of others. Because of the refusal to face the facts about the cause, effect, and treatment of VD, many infected persons either were not diagnosed and treated or they resorted to drugstore cures or treatment by quacks. As a result, many children were born dead or with malformations resulting from congenital syphilis. Others were blinded through infection of the eye with gonococci during childbirth. Venereal diseases accounted for a large percentage of insanity, paralysis, heart disease, and lifetime crippling. Currently, venereal disease is a complex problem having both medical and sociological overtones that are inseparable. The venereal diseases of greatest importance to the Army are gonorrhea and syphilis. Of lesser but still significant importance herpes, chancroid, lymphogranuloma venereum, and granuloma inguinale.

### **1-30. TRANSMISSION OF VENEREAL DISEASES**

Venereal diseases are almost always acquired by sexual contact with an infected individual. Direct contact with the lesions (sores) caused by the disease or with material from the lesions is the method of transmission. The lesions are usually on the genitals. When an infected person has a lesion about the mouth, the disease can be transmitted by kissing or any other direct contact with the sore. Indirect transmission by contaminated articles, while possible, can be ruled out for practical purposes because of the inability of the causative organisms to survive outside the body for over a minute or so. Pregnant women with syphilis may transmit the disease to the fetus after the fourth month of pregnancy by placental transfer. Syphilis may be transmitted by blood transfusion, but proper processing normally precludes this possibility. Children born of

women with gonorrhea may contract an infection of the eyes that can result in blindness if not treated promptly. The practice of applying silver nitrate drops to the eyes of all newborn infants keeps this type of infection at a low incidence. Venereal diseases are spread by homosexual contact as well as heterosexual contact. Susceptibility to VD is universal. Contracting a venereal disease affords no immunity against the disease and reinfection is common. There are no known immunizing agents against VD. The best method of avoiding VD is abstaining from sexual contact with an infected person.

## 1-31. GONORRHEA

a. **General.** Gonorrhea ("clap," "dose," "the drip," "gleet," "strain") is the most prevalent venereal disease among the reported VD cases in the US. It is caused by the diplococcus *Neisseria gonorrhoea*, frequently referred to as the gonococcus. The gonococcus is a relatively delicate organism that requires both warmth and moisture for its survival.

### b. Symptoms.

(1) Males. The classical symptoms of gonorrhea in the male consist of yellow pus-like discharge from the penis accompanied by a burning sensation and frequent urination. Symptoms may appear from 2 to 14 days after sexual exposure. In some cases, the symptoms may be mild or absent altogether. Occasionally, the incubation period may be 30 days or longer.

(2) Females. In females, infections without symptoms are very common. When present, they are usually mild and may be overlooked or ignored. Symptoms in females include increased vaginal discharge, yellow pus-like discharge from the cervix and/or urethra, burning and frequent urination, and discomfort during sexual intercourse. Women taking birth control pills may have an increased amount of vaginal discharge; therefore, symptoms of gonorrhea may be masked. The value of clinical examination in females cannot be overemphasized.

c. **Complications.** If untreated, gonorrhea may spread throughout the genital organs, causing inflammation of the testicles and prostate gland in men and inflammation of the fallopian tubes and related internal organs in women. Infections of the throat and anus are not uncommon in either sex. In advanced cases, the gonococcus may enter the bloodstream and cause arthritis, dermatitis, meningitis, or other complications.

d. **Treatment.** Gonorrhea can be treated with penicillin, tetracycline, or spectinomycin. The disease does not "go away" like a common cold. Even if the symptoms disappear, the disease is still present in the body and requires treatment.

## 1-32. SYPHILIS

a. **General.** Syphilis ("lues," "bad blood," "pox") is an acute or chronic systemic disease caused by the organism *Treponema pallidum*, a spirochete. It is one of the most widespread of communicable diseases. Untreated syphilis normally occurs in four stages: primary syphilis, characterized by a sore at the site of infection; secondary syphilis, characterized by systemic infection with a generalized skin eruption; long periods of latent syphilis with no outward symptoms; and late syphilis involving practically any organ and tissue in the body.

### b. Symptoms.

(1) Primary syphilis. The first symptom of syphilis is normally the appearance of an open sore called a chancre. The chancre appears from 10 to 90 days (average three weeks) following sexual exposure. It usually appears at the site of entry of the spirochete. The usual location of the chancre is on the genital organs, but it may also occur on the lips, tongue, breasts, fingers, anus, or other location. Infections without chancres are frequent and often the chancre is so small and painless that it causes no concern. In women, the chancre may be internal and easily overlooked. Since the appearance of a chancre is so variable, any person with a genital lesion should report to a medical clinic immediately for further examination.

(2) Secondary syphilis. The infected person enters the secondary stage anytime from two weeks to six months (usually four to seven weeks) after the appearance of the chancre. The chancre has normally disappeared by this time without treatment. The secondary stage is marked by a generalized skin eruption. Other symptoms of secondary syphilis that may occur include enlarged lymph glands, lesion in the mouth and genitalia, small moist flattop elevations in the skin of the genitalia, sore throat, headache, and fever. Symptoms of secondary syphilis are quite variable; therefore, anyone with a skin rash or eruption who has had recent or frequent sexual exposure should report to a medical clinic for examination.

(3) Latent syphilis. Following disappearance of secondary symptoms (which usually occurs spontaneously within a period from several weeks to a year after they occur), a period of latency follows. The periods of latency may last from several weeks to life, during which there may be recurrences of symptoms.

(4) Late syphilis. Late syphilis may involve destructive lesions of the skin, bone, internal organs, or the central nervous system. While actual fatality rates cannot be accurately estimated, late syphilis impairs physical and mental health, shortens life, and limits occupational efficiency.

c. **Treatment.** Penicillin is the treatment of choice and can usually be carried out in a duty status. Favorable results may be anticipated in over 90 percent of the cases discovered and treated in the primary stage and in 75 to 85 percent of those treated in the secondary stage. If the patient is allergic to penicillin, erythromycin is used instead.

### 1-33. HERPES SIMPLEX, TYPE 2

a. **General.** Herpes simplex occurs in two forms--herpes simplex virus, type 1, and herpes simplex virus, type 2. Type 1 is the "cold sore" or "fever blister" found usually in the mouth area. The type 2 form, often called "genital herpes," causes infections primarily in and around the genital area. Genital herpes is the fastest-growing sexually transmitted disease in the US.

b. **Transmission.** Herpes simplex, type 2, is highly contagious and can be transmitted from a person who has the sores present to another person during sexual intercourse. The disease can also be transmitted to babies who are delivered vaginally when the mother has sores present.

c. **Symptoms.** Symptoms such as burning and itching in the genital area, headaches, fever, and swollen glands can occur within three weeks after exposure. These symptoms are followed one to two weeks later by sores on the infected area. When the disease enters its dormant stage within six weeks, these sores will disappear on their own. The signs and symptoms (burning and itching, headaches, swollen glands, etc., followed by the sores) may reoccur at any time. Persons with genital herpes must refrain from sexual intercourse during the time that the disease is not dormant in order to prevent infecting sexual partners.

d. **Treatment.** There is no known cure for genital herpes, but medication is available by prescription that will help the sores to heal during the infectious stage.

### 1-34. OTHER VENEREAL DISEASES

Three other venereal diseases that are of military importance are chancroid, lymphogranuloma venereum, and granuloma inguinale. All three conditions are primarily tropical diseases, but also occur in the US.

a. **Chancroid.** Chancroid is characterized by rapidly developing pus-filled blisters on the genitalia occurring three to five days after exposure. When these blisters rupture, other sores develop from the pus. These sores are painful and dirty in appearance. They may be accompanied with painful swelling of lymph nodes in the groin area.

b. **Lymphogranuloma Venereum.** Lymphogranuloma venereum begins as sores on or around the genitalia. These sores occur from five to 21 days after exposure. The disease, if left untreated, will spread to the lymph system. It can also cause scar tissue to develop within the rectum and great swelling (elephantiasis) of the external genitalia.

c. **Granuloma Inguinale.** Granuloma inguinale begins as a small pimple or painless ulcer on the genitalia occurring one to 12 weeks after exposure. The disease spreads by forming other blisters or nodules. Chronic pus-filled blisters and beefy-red

open sores develop on the skin in the groin area. The disease may last for years and cause general ill health.

### **1-35. CONTROL OF VENEREAL DISEASE**

Control measures consist primarily of preventing the spread of the disease and treating those persons with the disease. The best methods of avoiding venereal disease are abstaining from sexual contact and having sexual contact with only one partner. Some other methods of attempting to control the spread of venereal disease are given below.

a. **Personal Hygiene.** An individual can minimize the chance of being infected by observing the following simple personal protective measures:

(1) Prophylaxis. The use of a rubber prophylactic (condom) affords a reasonably good protection against venereal disease for both males and females since it provides physical separation of the sex organs. Women should insist upon it since there is no other practical mechanical device that will protect them from contamination by male secretions.

(2) Urination. Urination immediately following sexual intercourse is considered to be of some value in flushing venereal disease organisms out of the urinary tract. This applies both to males and females.

(3) Washing. Thorough washing of the genitals with soap and water after intercourse may reduce the probability of acquiring a venereal disease infection for males and females. Vaginal douching after intercourse, however is not recommended, since the washing action may actually push the disease organisms further into the female organs.

b. **Early Detection and Treatment.** With adequate early treatment, hospitalization of infected persons is rarely necessary. Complete recovery is almost certain in most cases. Any person who has a genital sore, a urethral discharge, or a skin rash should be advised to report to a medical treatment facility. Self-treatment or treatment by other than professional medical practitioners is extremely dangerous and must not be attempted. Contracting venereal disease is not a cause for disciplinary action, but failing to report for proper medical treatment can result in disciplinary action.

c. **Contact Investigation.** When a case of venereal disease is reported or diagnosed, the infected individual is interviewed immediately by a trained interviewer. The purpose of the contact interview is to identify and locate all contacts from whom or to whom the disease could have been transmitted. Close cooperation with civil authorities is necessary in most cases to trace and locate contacts. When located, these contacts are advised that they have been exposed to the disease and are urged to seek examination and treatment. It is stressed to the person being interviewed that all information given is for the use of health authorities only and will be held in strict confidence.



d. **Control of Prostitution.** Most cases of venereal diseases are acquired from "friends" rather than from prostitutes. Nevertheless, prostitutes constitute a venereal disease source--particularly in overseas areas. Installation and area commanders, upon the recommendations of local Armed Forces disciplinary control boards, should impose "off limits" restrictions on all known houses of prostitution and other establishments which encourage casual sexual encounters among patrons.

e. **Education.** All possible means should be used to educate members of the military community concerning venereal diseases. The information provided should cover all aspects of the disease and be presented honestly and factually without attempts to moralize or threaten. A venereal disease education program which gives complete information in graphic terms describing the devastating effects of untreated venereal disease on the bodies of men and women, as well as their unfortunate offspring, will contribute toward the control of venereal disease. Expressed interest in the health and welfare of the individual and assurances of immunity from punitive action will reinforce the effectiveness of the education effort.

f. **Recreational Activities.** Provision of wholesome leisure time activities at convenient locations within easy access by all personnel serves as a positive alternative to sexual promiscuity. Recreational activities should include a wide range of cultural, intellectual, athletic, and social functions that appeal to servicemen and servicewomen.

## Section VII. MISCELLANEOUS DISEASES

### 1-36. TETANUS

Tetanus ("lockjaw") is an extremely serious disease. It has a mortality rate of 30 to 70 percent in the absence of effective immunization. The disease is caused by a toxin produced by an anaerobic bacillus, *Clostridium tetani*. This organism is found in soil throughout the world and is particularly prevalent in horse manure. The disease may follow any wound, burn, surgery, or other condition by which the bacteria may gain entry into the body--particularly a puncture wound. The toxin, acting on the spinal cord, causes stiffness of the jaw followed by spasms of the muscles of the neck and jaw. When death occurs, it is caused by respiratory failure due to spasms of the respiratory muscles. An effective vaccine is available and is administered routinely to all military personnel. A booster shot is administered whenever an injury occurs which involves a break in the skin.

### 1-37. RABIES

a. **General.** Rabies is an acute viral disease of mammals--including man. It is not an important disease in terms of frequency since few human cases occur; however, it is extremely important in that it is almost always fatal once the symptoms have appeared. The disease is caused by a virus, which attacks the central nervous system. Reservoirs include dogs, foxes, coyotes, wolves, jackals, bats, skunks, raccoons, cats, and many other biting mammals.

b. **Clinical Features.** Rabies is transmitted by the bite of an infected animal. The infective period when the virus is present in the animal's saliva is from three to five days before symptoms appear until death. Rabies symptoms in animals appear in three stages: the prodromal stage (fever and dilated pupils) lasting two to three days, the excitation stage (lasting three to seven days, and the paralytic stage lasting one to four days. The excitation stage during which the animal becomes vicious or lethargic and froths at the mouth is the most dangerous stage. During this stage, animals will bite without provocation and wild animals may appear to be tame. When a human contracts the disease, the first symptoms are headache, fever, restlessness, and a sense of apprehension. The disease progresses to uncontrollable excitement. Spasms of the throat make attempts to swallow so painful that the patient has a fear of water (hydrophobia). Death usually occurs in two to six days caused by respiratory paralysis.

c. **Control.** Rabies control is through prevention. All dogs and cats should be vaccinated for rabies. Dogs and cats known to have been bitten by a rabid animal should be destroyed or detained for observation in a kennel. Wild animals appearing to be tame should be avoided and destroyed. If a person is bitten by any animal, the animal should be apprehended alive and detained under the observation of a veterinarian. If it is not possible to capture the animal alive, the head should be taken intact, packed in ice, and delivered to the nearest veterinarian for examination. The bite wound should be immediately and thoroughly cleaned with soap and water. Following first aid, the patient should be referred to a physician for treatment. Rabies immunizations should be administered if it cannot be positively established that the animal did not have rabies.

### **1-38. SERUM HEPATITIS**

Serum hepatitis (hepatitis B) is a viral disease similar to infectious hepatitis (hepatitis A) in its symptoms (paragraph 1-22d). Hepatitis B is more serious than hepatitis A and has a fatality rate of 6% to 12 percent. Hepatitis B can be transmitted through whole blood, plasma, serum, and other blood products from an infected person. Contaminated hypodermic needles, syringes, and other intravenous equipment are also important vehicles of transmission. Patients undergoing transfusions or otherwise exposed to blood or blood products are always at risk. Incidence is high among narcotics users. Cases have also been traced to tattoo parlors. This disease has particular significance to persons involved in sterilizing and handling intravenous and/or hypodermic supplies and equipment.

### **1-39. DERMATOPHYTOSIS**

Dermatophytosis, or ringworm, is a general term applied to infections of the skin, hair, and nails caused by various fungi. The dermatophytoses, while generally not serious, make up a considerable number of the medical cases treated in military health care facilities--particularly in tropical and subtropical climates.

a. **Site of Infection.** The dermatophytoses are subdivided according to sites of infection:

(1) Ringworm of the scalp is common among children, but it does not constitute a large number of the cases of dermatophytosis in military populations.

(2) Ringworm of the body is common among troops. The most frequently affected area is the inner surfaces of the thighs in the groin area. This condition is known as "jock itch" and is aggravated by heat, moisture, and friction. It is a particular problem among troops who must make long marches in hot, humid weather.

(3) Ringworm of the foot ("athlete's foot") is another skin infection common among military troops. It usually starts as itching and scaling between the toes and progresses to painful cracks, blisters, and thickened dead skin. Secondary bacterial infections may occur which are sometimes severe enough to immobilize the patient.

(4) Ringworm of the nails is usually a direct extension of an adjacent skin infection resulting in the thickening and discoloration of the nail. Once acquired, these infections are extremely difficult to eliminate. Systemic medicine is usually required.

b. **Prevention and Treatment.** Dermatophytosis is best prevented by strict personal hygiene. Frequent bathing and washing of feet are the most beneficial measures. Socks and underwear should be changed frequently and kept as dry as possible. Issued foot powder should be sprinkled liberally in the shoes and socks and rubbed onto the feet. Body powder may be used to help reduce friction in the groin area and other areas where clothing fits snugly. Clothing should be worn as loosely as possible to permit air circulation. Persons having minor skin irritations should report to the aid station or troop clinic for medication before the condition becomes severe.

## **1-40. SCABIES**

Scabies is an infectious disease of the skin caused by a mite, a small arachnid, which burrows into the skin and reproduces. Infection is unnoticed at first, but after several days intense itching begins, especially at night. Upon close examination, tiny papules or burrows containing the mites and their eggs can be seen. Infection is most common around the finger webs, belt line, external genitalia, and other places where the skin is very tender. The parasites are transmitted primarily by direct contact, but may also be transmitted by undergarments or soiled bedclothes freshly contaminated by infected persons. Scabies is a disease usually associated with war, poverty, or social upheaval. It is uncommon where bathing is frequent.

**Continue with Exercises**

## EXERCISES, LESSON 1

**INSTRUCTIONS:** The following exercises are to be answered by circling the letter of the response that best answers the question or best completes the incomplete statement.

After you have completed all of the lesson exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. What are the five classes of communicable diseases?

\_\_\_\_\_ diseases.

\_\_\_\_\_ diseases.

\_\_\_\_\_ diseases.

\_\_\_\_\_ diseases.

\_\_\_\_\_ diseases.

2. Name the six links in the chain of disease transmission.

\_\_\_\_\_.

\_\_\_\_\_.

\_\_\_\_\_.

\_\_\_\_\_.

\_\_\_\_\_.

\_\_\_\_\_.

3. A person who harbors disease organisms, but is not ill, is known as a(n)

\_\_\_\_\_.

4. The term "communicable disease" refers to a disease that can be transmitted:
  - a. From one person to another.
  - b. From an animal to a person.
  - c. From a person to an animal.
  - d. From one animal to another.
  - e. By one or more of the above methods.
  
5. A communicable disease that is spread by sneezing is called a(n):
  - a. Arthropod-borne disease.
  - b. Intestinal disease.
  - c. Respiratory disease.
  - d. Venereal disease.
  
6. Most parasitic worms found in raw meats can be destroyed by cooking meat at proper temperatures for the proper amount of time.
  - a. The statement is true.
  - b. The statement is false.
  
7. Antibiotics started to be used to successfully treat diseases in the:
  - a. 1860's.
  - b. 1890's.
  - c. 1910's.
  - d. 1940's.

8. A person who has been exposed to a communicable disease recently but who has no signs and symptoms of the disease may be required to see a medical person on a daily basis for a period of time. This is an example of:
- Isolation.
  - Medical surveillance.
  - Quarantine.
9. When sleeping areas are crowded, persons should sleep \_\_\_\_\_ in order to try to control the spread of respiratory diseases.
- Head-to-head.
  - Head-to-foot.
10. Immunity acquired by actually "catching" a disease is referred to as \_\_\_\_\_ immunity.
11. The most widespread venereal disease in the United States is:
- Chancroid.
  - Gonorrhea.
  - Lymphogranuloma venereum.
  - Syphilis.
12. Salmonellosis is:
- A viral disease transmitted through sexual intercourse.
  - A type of poisoning caused by a toxin formed by bacterial action in food.
  - A bacterial disease caused by fecal contamination of food and water.

13. Of the following, which is the best way to avoid being infected with a venereal disease?
- Clean all toilet seats before using them.
  - Avoid sexual contact with persons who may have venereal disease.
  - Use of a condom during sexual intercourse.
  - Immunization.
14. You are using a bednet on your cot. After you get inside and tuck the bednet under your mattress, you should:
- Spray insecticide inside the bednet area for five seconds.
  - Have someone spray the outside of the bednet with insecticide for five seconds.
  - Spread M-1960 on the surface where you will sleep.
  - Spread louse powder on the surface where you will sleep.
15. Which one of the following will not help to prevent venereal disease in a female?
- Male using a condom.
  - Washing her genitals with soap and water after sexual intercourse.
  - Performing a vaginal douche after sexual intercourse.
  - Urinating immediately following sexual intercourse.
16. A person with syphilis always develops a chancre.
- The statement is true.
  - The statement is false.

17. The purpose of contact interviewing is to:
- a. Locate and prosecute prostitutes.
  - b. Locate witnesses in order to prosecute the infected individual.
  - c. Compile and publish a list of persons to be avoided by military personnel.
  - d. Locate and bring to treatment all persons who have been exposed to VD.

**Check Your Answers on Next Page**



## SOLUTIONS TO EXERCISES, LESSON 1

1. Respiratory.  
Intestinal.  
Arthropod-borne.  
Venereal.  
Miscellaneous. (para 1-17)
2. Causative agent.  
Reservoir.  
Mode of escape.  
Mode of transfer.  
Mode of entry.  
Susceptible host. (para 1-3; fig 1-1)
3. Carrier (para 1-5b)
4. e (para 1-1)
5. c (para 1-19)
6. a (para 1-14b(2))
7. d (para 1-11a(1))
8. b (para 1-12c)
9. b (para 1-20d(1))
10. Natural (para 1-16a(1))
11. b (para 1-31a)
12. c (para 1-22c(1))
13. b (para 1-35)
14. a (para 1-28d, e)
15. c (para 1-35a)
16. b (para 1-32b(1))
17. d (para 1-35c)

**End of Lesson 1**

## LESSON ASSIGNMENT

### SUBCOURSE MD0535

Communicable Diseases and Field Sanitation.

### LESSON 2

Field Water Supply.

### TEXT ASSIGNMENT

Paragraphs 2-1 through 2-15.

### LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 2-1. Identify the proper definition of terms commonly used in preparing water for use.
- 2-2. Select the safest probable source from several possible field water sources.
- 2-3. Indicate whether a given water source is safe for consumption.
- 2-4. Identify and/or place in proper sequence the critical steps in disinfecting water in the field including the use of bulk calcium hypochlorite, calcium hypochlorite ampules, iodine tablets, commercial bleach, and boiling.
- 2-5. Select and/or place in proper sequence the steps in measuring the chlorine residual in a water sample using the vial comparator.
- 2-6. Identify the procedures for cleaning and disinfecting containers used to transport or store potable water.
- 2-7. Given a situation, estimate the amount of potable water required.

### SUGGESTIONS

After studying the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

## LESSON 2

### FIELD WATER SUPPLY

#### Section I. GENERAL

##### 2-1. MEDICAL IMPORTANCE OF WATER

Water is probably the most important item of supply to a military force. An adequate supply of water is essential to the success of any military operation. During times of extreme heat, lack of water can put a soldier out of action within a day. Moreover, water that is unsafe to drink may be little better than none at all. Polluted water may put entire units out of action.

a. **Quantity of Water.** The amount of water necessary for any given number of persons varies. The season of the year, the geographical location, and the tactical situation are factors that must be taken into consideration when estimating minimum requirements. In a hot, dry climate, a man performing normal duty may require as much as two to six gallons of water per day for drinking purposes. In a cooler climate, however, he may require only one-half to one gallon per day for the same purpose. Similarly, amounts required for cooking and for personal hygiene uses vary greatly. A guide for planning to meet water requirements in a temperate climate is five gallons per man per day for drinking and cooking. If showering facilities are to be made available, the amount required will be at least 15 gallons per man per day.

b. **Quality of Water.** The quality of water is based upon its potability and its palatability.

(1) Potable. Potable water is water that is safe for human consumption. It must be free from disease-producing organisms, excessive amounts of mineral and organic matter, radioactive material, CBR agents, and poisonous substances.

(2) Palatable. Palatable water is water that is pleasing to the taste. To be palatable, it should be relatively free from color, turbidity (cloudiness or muddiness), taste, and odor. It should also be cool and well aerated. It is important to understand that palatable water is not always potable nor is potable water always palatable.

(3) Contaminated. Water that is unfit for human consumption is said to be contaminated. The water may contain sewage, garbage, disease-producing organisms, excessive amounts of minerals or organic matter, toxic chemicals, radioactive materials, or a combination of these. Contaminated water is not potable and is usually not palatable.

(4) Brackish. Brackish water contains a high level of minerals and dissolved solids (over 500 ppm) and tastes salty.

## 2-2. WATERBORNE DISEASES

All water that is to be used for drinking or cooking must be potable (free from disease-producing organisms). Some of the intestinal diseases that may be transmitted by contaminated water are cholera, shigellosis, and infectious hepatitis (hepatitis A). These diseases were discussed in Lesson 1. The following diseases are also transmitted by water.

a. **Typhoid Fever.** Typhoid fever is a serious disease caused by *Salmonella typhi*, a bacillus of the same genus as those causing salmonellosis (bacterial food poisoning). Signs and symptoms of typhoid fever include fever, headache, rose spots on the body, loss of appetite, and a generalized ill feeling. Diarrhea is sometimes present, but constipation is more common. The death rate is about two percent with antibiotics and around 10 percent without antibiotics. Fortunately, the disease is very rare among military personnel since immunization against typhoid is a standard procedure.

b. **Amebiasis (Amebic Dysentery).** Amebiasis is a parasitic disease caused by ingesting the cysts of the protozoan *Entamoeba histolytica*. Signs and symptoms of the disease may vary from mild abdominal discomfort to acute dysentery with fever, chills, and blood or mucus in the stools. Individuals may harbor the cysts in their intestinal tracts--with or without symptoms--for years. The disease occurs worldwide, but it is most prevalent in areas with poor sanitation in the developing countries of Africa, the Far East, and the Tropics.

c. **Schistosomiasis (Bilharziasis).** Schistosomiasis is a parasitic disease caused by the invasion of the body by microscopic-sized larvae of several species of parasitic worms known as schistosomes (blood flukes). These larvae spend a part of their life cycle in the bodies of certain fresh water snails. These snails are found principally in Africa, South America, the Caribbean, and the Far East (including Japan and the Philippines). The larvae are capable of penetrating the skin of persons bathing or wading in infested waters. They will also penetrate the stomach lining if infested water is drunk without being disinfected. Once in the body, the larvae migrate to the blood vessels where they mature. The adult is about one-half inch long. The adult schistosomes migrate to the liver, bladder, or lungs and cause obstructions of the blood vessels in those organs. Symptoms of the disease may include an upper digestive discomfort, flatulence, nausea, and intolerance to muscular effort. Continued infection may lead to loss of weight, malnutrition, intolerance of food, abdominal distension, easy fatigue, and lack of resistance to infections. Such late complications as liver failure, cancer of the bladder, and obstruction of the blood vessels of the lungs may be fatal. An important aspect of this disease is that it poses a hazard not only to those who drink water contaminated with the parasites, but also to those who wade, swim, or bathe in it.

## 2-3. RESPONSIBILITIES FOR WATER SUPPLY

a. **Commander.** The unit commander is responsible for providing adequate amounts of potable water for his troops. He must enforce the rules of water discipline (para d below) and ensure that each individual thoroughly understands the danger of drinking contaminated water. When treated water is not obtainable, the commander must ensure that proper water treatment methods are used in his unit. The unit field sanitation team assists the commander in carrying out these responsibilities.

b. **Army Quartermaster Corps.** The Quartermaster Corps has the mission of procuring, treating, and distributing water. In the field, quartermaster units normally operate mobile water purification units near available sources of water. These areas become "water points." Water points are treatment and storage facilities from which troop units obtain potable water. The water can be transported using water trailers belonging to the unit, water cans, or other approved water containers.

c. **Army Medical Department.** Army Medical Department personnel recommend standards for water quality, conduct bacteriological and chemical examinations of water, and advise commanders and quartermaster personnel on purification methods. They also inspect water supply systems and water points and, after appropriate laboratory and field examination, approve or disapprove the water supply for consumption.

d. **Individuals.** Whether in the field or in garrison, each soldier is responsible for observing the rules of good water discipline. Three important rules are:

(1) Drink only from approved water sources--untreated water usually is contaminated.

(2) Conserve water--do not waste it.

(3) Do not contaminate or pollute water sources.

e. **Safety of the Source.** Water from any source, except a public supply system approved by the Army Medical Department, is presumed to be contaminated. Water from unapproved sources, therefore, must be properly treated before it can be used.

## 2-4. STORAGE OF POTABLE WATER

a. **Quartermaster Water Treatment.** Water supplied to troops at water points has been treated by mobile water purification equipment. This type of equipment produces potable water of high quality using the processes of sedimentation, filtration, and disinfection by chlorination. The finished water is stored in suitable containers, usually collapsible fabric storage tanks such as shown in figure 2-1, and provided with pumps and hoses for filling unit water storage containers.

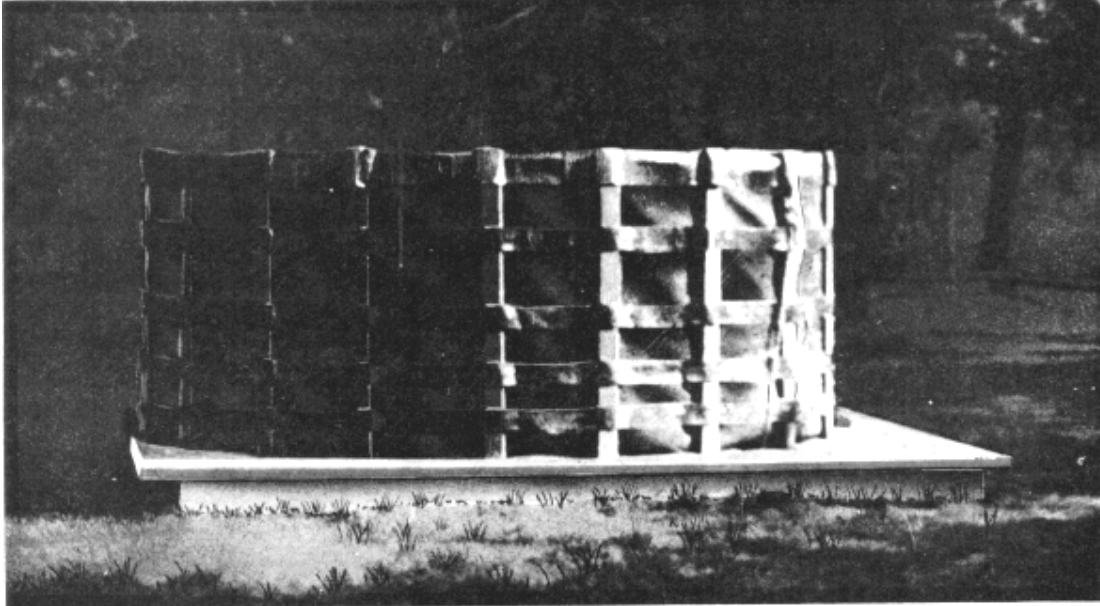


Figure 2-1. 3,000-gallon collapsible fabric water tank on raised platform.

b. **Transporting Potable Water.** When unit personnel obtain potable water from the designated water point, care must be taken to ensure that this treated water does not become recontaminated while hauling it to the unit area. Water trailers, tank trucks, and water cans used to transport water must be clean upon arrival at the water point. To the maximum extent possible, they should only be used for hauling potable water. Containers used to haul nonpotable water must be cleaned and then disinfected with a 100-ppm (parts per million) chlorine solution before being used to transport potable water. New trailers, tank trucks, and water cans are to be disinfected prior to initial use. The disinfecting solution can be prepared by adding one ampule of calcium hypochlorite to one gallon of water or adding two ounces (five level mess kit spoonfuls) of bulk calcium hypochlorite to 100 gallons of water. The interior surfaces of trailers, tanks, and cans must be properly maintained. They should be inspected periodically for rust and chips in interior enamel, tightness of seals and seams, and cleanliness.

c. **Lyster Bags.** In the unit area, the "Lyster" bag may be used to store and dispense the treated water to troops. Water is transferred from the water tank or trailer into these 36-gallon canvas containers. Lyster bags are issued to units on the basis of one bag per 100 men. The bags are made of porous canvas that permits seepage of water and cooling by evaporation. The bags are set up as illustrated in figure 2-2 before they are filled with water. The weight of the water in these bags may cause the supporting ropes to stretch, thus causing a gap between the cover and the bag. Should this occur, the ropes should be adjusted so that the cover will again fit snugly around the upper part of the bag and thus prevent contamination of the water by dust and insects. The bags should be inspected frequently for cleanliness. If they are dirty, they should be scrubbed, treated with a strong solution of chlorine (one ampule of calcium hypochlorite to one gallon of water), and rinsed several times with potable water.

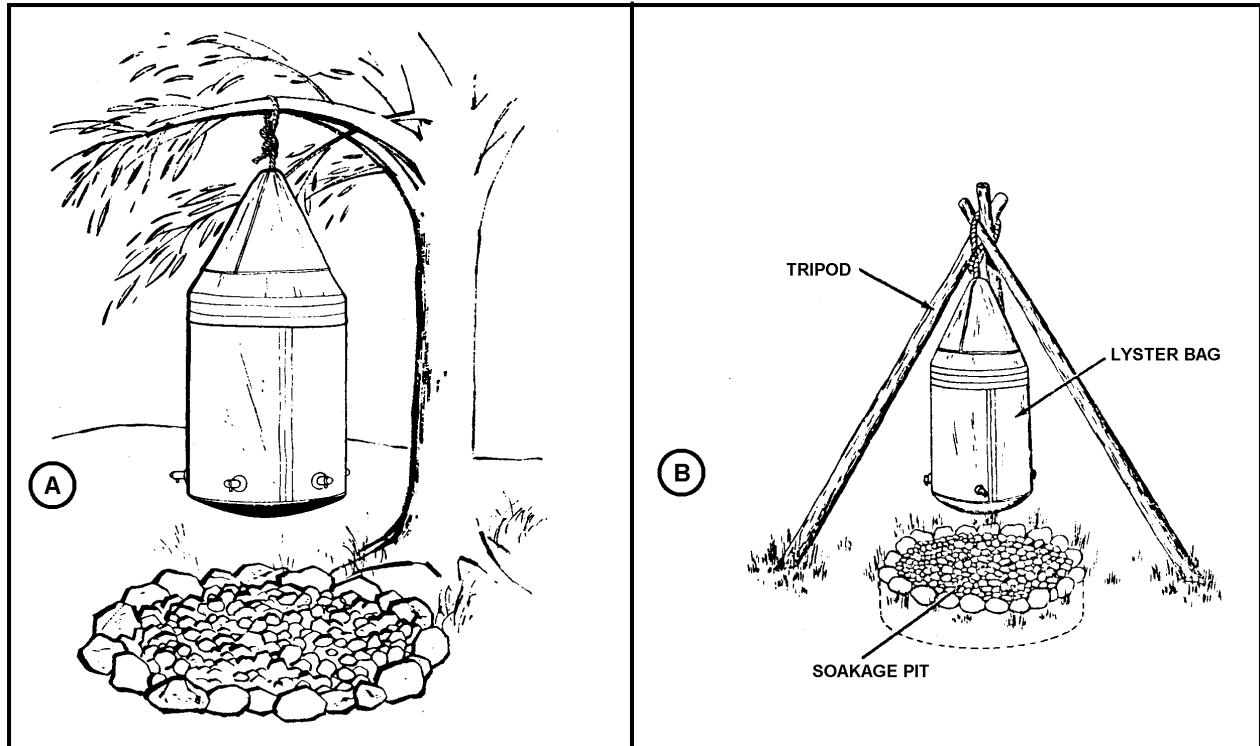


Figure 2-2. Lyster bag setups. A Tree branch. B Tripod.

**NOTE:** Lyster bags are gradually being phased out of the Army system. The 400-gallon water trailer will replace the Lyster bag as the primary means of dispensing water to soldiers in units.)

d. **Emergency Water Containers.** In an emergency, cans may be cleaned and used to hold potable water. (**NOTE:** Cans to hold petroleum products such as gasoline are used only as a last resort in an extreme emergency since petroleum residue cannot be completely removed using this cleaning process.) The newest, cleanest cans with a bright interior should be selected and cleaned as follows.

- (1) Drain the can thoroughly for 10 to 15 minutes.
- (2) Fill the can half full of water and add one ounce of powdered detergent.
- (3) Close the can and shake it for five minutes.
- (4) Discard this wash water.
- (5) Rinse the can with water three or four times.
- (6) Fill the can to overflowing.
- (7) Discard this water.

- (8) Fill the can with water.
- (9) Add the contents of five calcium hypochlorite ampules.
- (10) Close the can and shake it to mix the calcium hypochlorite with the water.
- (11) Let the can stand for one hour.
- (12) Empty the can. The can is now ready to be used to store drinking water.

## **Section II. FIELD WATER TREATMENT**

### **2-5. EMERGENCY WATER SUPPLY**

Units that are not able to obtain water from established quartermaster water points must find and treat their own water. Water may be obtained from surface water sources (lakes, rivers, streams, and ponds), from ground water sources (wells and springs), and sometimes from public water supplies. In combat, there is usually not sufficient time to search for the most desirable water supply. Advantage must be taken of whatever water is available, provided it can be purified with the material at hand. When time and the situation permit, a wider search for a better source is made. In some locations, it may be necessary to use rainwater, distilled seawater, or melted ice or snow. The availability of water is an important factor in the selection of bivouac sites and camps.

### **2-6. SELECTION OF WATER SOURCES**

a. **Types of Sources.** The selection of a water source depends on the quantity of water required, the accessibility of the source, the type of source, and the type of water purification equipment on hand. If water is readily available and sources are free from unusual impurities, the order of preference in the selection of sources is:

- (1) Public water supplies.
- (2) Wells or springs.
- (3) Surface water sources.
- (4) Rain, snow, or ice.

**NOTE:** In an underdeveloped country, groundwater--wells and springs--may be preferred over the public water system as the primary source of water.

b. **Location.** A source should be selected which is as free as possible from known contamination. When several otherwise equally desirable sources are available,



the water that is easiest to purify should be chosen. Less personnel and equipment are required to purify water from a clean supply than from a supply of questionable quality.

(1) Ground water. Ground water is usually less contaminated than surface water and is, therefore, a more desirable water source. However, this source is limited. A ground water source (well or spring) should be at least 100 yards from sources of contamination such as latrines or soakage pits. The water source should be higher than the surrounding ground so that surface water drains away from the water source. (If the water source is in a low area, drainage from latrines, soakage pits, and other sources of possible contamination may contaminate the water.)

(2) Surface water. Although surface water is usually more contaminated than other sources, it is commonly used in the field because it is generally more accessible in the quantity required. The water intake or the point of supply of a surface source should be as far away as possible from known sources of contamination. When a stream is used, the water should be obtained upstream from any source of contamination. In lakes and ponds, it is generally desirable to take water as far from the shore as practicable since the amount of contamination is usually higher near the shore.

## **2-7. SETTLING WATER FROM A STREAM**

Turbid (cloudy) water should be settled before it is used. A settling basin may be constructed by digging a trench parallel to a stream bank into which water from the stream may seep and remain still. Another method is to dig a short ditch from one side of a stream leading to a basin where the water can stand and debris can settle to the bottom. After the dirt has settled, the clear water may be removed to a clean container and disinfected by chlorination or by boiling.

## **2-8. CHLORINATION**

When treating water at the unit and individual level, complete reliance is placed upon the disinfection process. The disinfectant most often used in purifying water for drinking and other domestic purposes is chlorine in the form of calcium hypochlorite. Calcium hypochlorite is supplied in bulk and, also, in glass ampules that hold a half gram of the substance. It is added to the water in the amount necessary to destroy all of the pathogens (disease-producing microorganisms) presently in the water with some chlorine remaining to serve as a continuing disinfectant.

a. **Terms Used in Water Treatment.** Some of the terms used in the treatment of water are defined below:

(1) Water treatment. Water treatment refers to the removal of undesired elements in the water to be used. Disinfection, coagulation, sedimentation, and filtration are some of the procedures that may be used in water treatment.

(2) Disinfection. Disinfection refers to the treatment of the water with chemicals or by boiling to destroy disease-producing organisms.

(3) Chlorination. Chlorination is the disinfection of water by the addition of a chlorine compound such as calcium hypochlorite.

(4) Chlorine dosage. The chlorine dosage is the amount of chlorine added to a given quantity of water.

(5) Chlorine demand. The chlorine demand is the amount of chlorine that reacts with, and is consumed by, organic material, bacteria, and other substances in water. In other words, it is the amount needed to kill the organisms living in the water.

(6) Chlorine residual. The chlorine residual is the amount of chlorine remaining after the demand has been satisfied. Dosage minus demand equals residual.

(7) Parts per million (ppm). Parts per million is a unit of measurement for expressing the number of units of a substance in one million units of water by weight. Another way of expressing ppm is milligrams per liter (mg/l).

b. **Chlorination Requirements.** Sufficient chlorine must be added to water to produce a given chlorine residual 30 minutes after the chlorine is added to the water. A five-ppm residual is the standard requirement for field water supplies. Higher or lower concentrations, however, may be prescribed by the command surgeon based on his knowledge of local diseases and environmental conditions. The minimum field requirement for the chlorine residual is one part per million (1 ppm).

c. **Chlorination Kit.** The chlorination kit (figure 2-3) is available to all units for use in chlorinating water and testing it for the proper chlorine residual. The kit contains calcium hypochlorite 0.5-gram ampules for disinfecting water together with three plastic tubes and three vials of orthotolidine tablets used in determining the chlorine residual. The vials of orthotolidine tablets are packed inside the plastic tubes. Each plastic tube has a band around the tube and each band is a different shade of yellow. The lightest shade of yellow is used to test for a one ppm level of residual, the medium shade is used to test for a five ppm level of residual, and the darkest shade is used to test for a ten ppm level of residual. These figures (1, 5, and 10) are printed on the tubes.

**NOTE:** Sometimes the five-ppm tube is not numbered.)

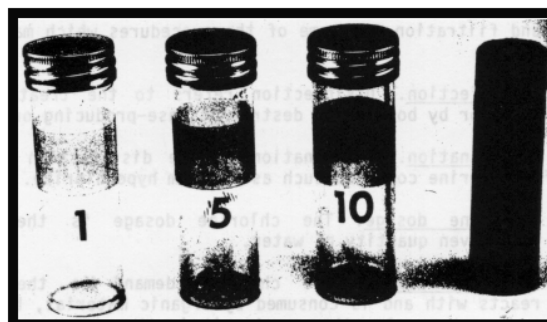


Figure 2-3. The chlorination kit.

## 2-9. DISINFECTING WATER IN A LYSTER BAG

Water is disinfected at the unit level by adding ampules of calcium hypochlorite, which are provided in the chlorination kit, to the water in a Lyster bag or other suitable container. The following procedures describe how water in a Lyster bag is treated to obtain a five-ppm chlorine residual.

a. **Clean and Hang Bag.** Clean the bag (see paragraph 2-4c) and hang it by the supporting ropes as illustrated in figure 2-2. The supports must be sturdy since the bag weighs approximately 300 pounds when filled with water.

b. **Fill Bag.** Fill the bag with water to the 36-gallon mark (about four inches from the top of the bag) with the cleanest water available.

c. **Prepare Disinfecting Solution.** Put the contents of at least three calcium hypochlorite ampules into a canteen cup, add a small amount of water from the Lyster bag, and stir with a mess kit spoon until a thick mixture results. Then fill the cup one-half full of water and stir again.

d. **Add Solution.** Empty the prepared solution slowly into the bag. There is no need to stir. You should never put foreign objects such as sticks into the water.

e. **Cover and Flush.** Cover the top of the bag and flush the faucets by running a small quantity of the water through each of the faucets. The flushing prevents any unchlorinated water from being trapped in the faucets and disinfects the insides of the faucets.

f. **Wait Ten Minutes.** Wait 10 minutes after adding the disinfecting solution. Waiting 10 minutes gives the chlorine time to kill disease-causing organisms in the water.

g. **Test Chlorine Residual.** If a five-ppm chlorine residual is present after 10 minutes, then most or all of the disease-causing organisms have been killed. If there is no chlorine residual present or if the chlorine residual is too low (not sufficient to prevent the water from becoming recontaminated), more chlorine will be needed. The procedures for testing chlorine residual are given below.

(1) Select the appropriate (number five) plastic tube from the three tubes provided in the kit.

(2) Take one orthotolidine tablet from the vial in the kit, place the tablet in the cap of the plastic testing tube, and crush the tablet with the bottom of the orthotolidine bottle.

(3) Empty the crushed tablet into the five-ppm testing tube.

(4) Flush the faucets of the Lyster bag.

(5) Fill the plastic tube to a point just below the bottom of the yellow band with water from the Lyster bag.

(6) Place the cap on the testing tube and shake the tube until the crushed orthotolidine tablet is completely dissolved.

(7) Compare the yellow shade of the water with the yellow shade of the band on the tube. If the color of the water is the same shade or darker than the band, the chlorine residual is equal to or greater than that printed on the tube. If a lighter color or no color is formed, the water does not have a sufficient chlorine residual--additional chlorination and testing are required.

h. **Add Additional Calcium Hypochlorite, If Needed.** If the test shows a chlorine residual less than five ppm, make a solution using water and one calcium hypochlorite ampule, add the solution to the water in the Lyster bag, stir, cover the bag, wait 10 minutes, and repeat the test. Continue this process until the chlorine residual meets or exceeds the five-ppm requirement.

i. **Wait Twenty Minutes.** When the test shows the chlorine residual to be at least five ppm, wait an additional 20 minutes. This additional time is needed to ensure that all of the disease-producing organisms have been killed.

j. **Retest the Chlorine Residual.** Test the chlorine residual again after the additional 20 minutes have elapsed using the same procedures given in paragraph g above.

(1) If the chlorine residual is equal to or greater than five ppm, the water is ready to drink.

(2) If the chlorine residual is less than five ppm, repeat the procedures listed in paragraphs h, i, and j above.

## 2-10. DISINFECTING WATER IN OTHER LARGE CONTAINERS

The same general procedures described in paragraph 2-9 can also be used to treat water in containers other than the Lyster bag, but a different amount of calcium hypochlorite must be used.

a. **Five-Gallon Can.** For a five-gallon can of water, the initial solution should be made with one-half of the contents of a calcium hypochlorite ampule. Additional small amounts should be added if needed.

b. **Fifty-Five-Gallon Drum.** For a 55-gallon drum of water, four or five ampules should be used to make the initial solution.

c. **Four-Hundred-Gallon Trailer.** For a 400-gallon trailer of water, a solution of 30 ampules or one heaping mess kit spoonful of bulk calcium hypochlorite should be initially.

d. **Other Containers.** Water in larger containers is not easily chlorinated using ampules. Bulk calcium hypochlorite should, therefore, be used. TM 5-700, *Field Water Supply*, contains a table that gives the amounts of calcium hypochlorite necessary to provide from 1-ppm to 200-ppm chlorine residual level in quantities of water from five gallons to 50,000 gallons.

## 2-11. DISINFECTING WATER IN A CANTEEN USING IODINE TABLETS

Occasionally, individuals or small groups may be required to operate away from their units and be without a potable water supply. In such instances, the individual soldier must be able to disinfect whatever water is available for his own use. The standard item of issue for this purpose is the iodine water purification tablet. Iodine tablets are issued in bottles of 50. Each individual is normally issued one bottle. Procedures for disinfecting water in a one-quart canteen using iodine tablets are given below.

a. **Check Tablets.** Before iodine tablets are used, they should be checked since they lose their disinfecting ability with time. Tablets that are not uniformly gray in color, which are stuck together, or which are crumbled should not be used. Discard any off-colored, stuck, or crumbled tablets and replace the cap on the bottle.

b. **Fill Canteen.** Fill the canteen with the cleanest, clearest water available.

c. **Remove Tablets.**

(1) Remove two iodine tablets from the bottle.

(2) Replace the cap on the bottle.

d. **Replace Bottle.** Make sure that the cap is tightly on the bottle. Then store the bottle where it will not be exposed to sunlight. (Sunlight causes the iodine tablets to deteriorate at a faster rate.)

e. **Add Tablets.** Add the iodine tablets to the water in the canteen and replace the cap on the canteen.

f. **Wait Five Minutes.** Allow five minutes for the tablets in the canteen to dissolve.

g. **Shake.** Shake the canteen to thoroughly mix the dissolved tablets with the water.

h. **Rinse Threads.** Loosen the canteen cap slightly and turn the canteen upside-down. This allows the treated water to seep around the neck of the canteen and rinse the threads. Removing contamination from this area is important since the threads and neck of the canteen will come into contact with your mouth when you drink from the canteen.

i. **Tighten Cap.** Return the canteen to a neck-up position and tighten the cap.

j. **Wait 30 Minutes.** Wait 30 minutes more before using the water. This allows sufficient time for the iodine to disinfect the water.

## 2-12. DISINFECTING WATER IN A CANTEEN USING CALCIUM HYPOCHLORITE

Although use of iodine tablets is the preferred method of disinfecting water in a canteen, a calcium hypochlorite ampule from the chlorination kit can be used when needed. Instructions for this procedure are given below.

a. **Fill Canteen.** Fill the canteen with the cleanest, clearest water available. Leave an air space of about one inch below the neck of the canteen.

b. **Prepare Solution.** Fill a canteen cup half full of water and add the calcium hypochlorite from one ampule. Stir with a clean mess kit spoon until the powder is dissolved.

c. **Measure Solution.**

(1) If the water in the canteen is clear, fill the cap to the canteen half full with the solution prepared in paragraph b above.

(2) If the water in the canteen is cloudy or very cold, fill the canteen cap to the top with the solution prepared in paragraph b above.

d. **Add Solution.** Pour the measured solution in the cap into the canteen and put the cap back on the canteen.

e. **Shake.** Shake the canteen to thoroughly mix the solution and the water.

f. **Rinse Threads.** Loosen the cap slightly and invert the canteen, letting the treated water rinse the threads around the neck of the canteen.

g. **Tighten Cap.** Turn the canteen upright and tighten the cap.

h. **Wait 30 Minutes.** Wait at least 30 minutes before using the water for any purpose. This allows sufficient time for the disinfection to take place.

## 2-13. DISINFECTING WATER IN A CANTEEN USING COMMERCIAL LIQUID CHLORINE BLEACH

The chlorine contained in regular liquid household bleach can be used to disinfect water when neither iodine tablets nor calcium hypochlorite are available.

- a. **Fill Canteen.** Fill the canteen with the cleanest, clearest water available.
- b. **Add Bleach.**
  - (1) If the water is clear, add two drops of bleach.
  - (2) If the water is cloudy or cold, add four drops of bleach.
- c. **Shake.** Replace the cap on the canteen and shake the canteen thoroughly. This will mix the bleach with the water.
- d. **Rinse Threads.** Loosen the canteen cap slightly and invert the canteen. Allow the treated water to rinse the threads and neck of the canteen.
- e. **Tighten Cap.** Turn the canteen upright and tighten the cap.
- f. **Wait 30 Minutes.** Wait at least 30 minutes before using the water. This allows time for the chlorine to kill disease-producing organisms present in the water.

## 2-14. DISINFECTING WATER BY BOILING

a. **Disadvantages.** Boiling is used when disinfecting compounds are not available. It is a good method for killing disease-producing organisms; however, it does have several disadvantages:

- (1) There is no residual protection against infection.
- (2) Fuel is needed.
- (3) It takes a long time for the water to boil and then cool.
- (4) Care must be taken to use clean containers for boiling the water.

b. **Procedure.**

(1) Select container. Select a clean container which will hold a sufficient amount of water and which can be treated. Do not use a plastic container like a container which is to transport gasoline, or other unsuitable containers.

(2) Fill container. Fill the container with the cleanest, clearest water available.

(3) Boil water. Bring the water to a rolling (bubbling) boil for at least 15 seconds. (Local policy may increase the boiling time based upon local conditions.)

(4) Cool. Allow the water to cool sufficiently before using as drinking water. Take measures to protect the water from becoming contaminated during the cooling process.

## **2-15. MAINTAINING CHLORINE RESIDUAL**

Water treated by quartermaster purification methods contains sufficient chlorine to destroy the organisms that cause intestinal diseases. However, it is difficult to prevent subsequent recontamination of the water when transferring the water from one container to another. Therefore, tests must be conducted periodically to check the chlorine residual. If the chlorine residual is below the level prescribed for the command, additional calcium hypochlorite must be added.

a. **Schedule Checks.** Water in a large container, such as a 400-gallon trailer, should be checked when it arrives and every three or four hours thereafter.

b. **Perform Residual Check.** Test the chlorine residual level using the same base procedures given in paragraph 2-9g.

c. **Add Disinfectant, If Needed.**

(1) If the test shows the water to have a chlorine residual equal to or greater than one ppm, no additional disinfectant is added.

(2) If the test shows that the chlorine residual is less than one ppm, additional disinfectant needs to be added to the water. For a 400-gallon trailer, add one heaping tablespoon of bulk calcium hypochlorite to the water. (If bulk calcium hypochlorite is not available, add 30 calcium hypochlorite ampules.) This should return the water to a 5-ppm chlorine residual.

d. **Continue Checks.** Continue to recheck the chlorine residual of the water according to schedule.

**Continue with Exercises**



## EXERCISES, LESSON 2

**INSTRUCTIONS:** The following exercises are to be answered by circling the letter of the response that best answers the question or best completes the incomplete statement.

After you have completed all of the lesson exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Which of the following diseases is especially dangerous because it can be acquired by wading in contaminated water?
  - a. Amebiasis.
  - b. Hepatitis.
  - c. Cholera.
  - d. Schistosomiasis.
  
2. Provision of an adequate supply of safe water for troops is the responsibility of the:
  - a. Quartermaster Corps.
  - b. Army Medical Department.
  - c. Unit commander.
  - d. Unit supply sergeant.
  
3. Select the most desirable source of drinking water for a small unit (20 persons).
  - a. A clear lake with good vehicle access.
  - b. A deep well with an adequate output of clear water.
  - c. A slow-moving muddy creek.

4. A person in a hot climate will require \_\_\_\_\_ drinking water when compared to a similar person in a similar job in a cooler climate.
- a. More.
  - b. Less.
  - c. About the same amount of.
5. Place in correct sequence the following steps in measuring the chlorine residual of a water sample:
- (1) Crush the orthotolidine tablet and put into the tube.
  - (2) Replace cap on tube and shake.
  - (3) Fill tube with water to a point just below the yellow band.
  - (4) Compare shade of water with shade of band on tube.
  - (5) Select appropriate tube for the desired chlorine residual.
- a. (1) - (2) - (3) - (4) - (5).
  - b. (5) - (4) - (3) - (2) - (1).
  - c. (5) - (1) - (3) - (2) - (4).
  - d. (5) - (3) - (1) - (2) - (4).
6. The principal disadvantage of boiling as a means of disinfecting water is that it:
- a. Requires too much time.
  - b. Requires gasoline.
  - c. Destroys necessary minerals.
  - d. Does not protect against recontamination.

7. Which of the following is the first step in treating water from a muddy stream?
- a. Measuring the chlorine residual.
  - b. Adding calcium hypochlorite.
  - c. Adding iodine tablets.
  - d. Removing dirt and/or debris.
8. A Lyster bag of water normally requires \_\_\_\_\_ calcium hypochlorite ampule(s) to establish a five ppm chlorine residual.
- a. 1
  - b. 3
  - c. 5
  - d. 30
9. The amount of chlorine needed to kill the disease-producing organisms in a container of water is called the:
- a. Chlorine demand.
  - b. Chlorine dosage.
  - c. Chlorine palatability.
  - d. Chlorine residual.

10. You are disinfecting water in a Lyster bag. You have just added the calcium hypochlorite solution and flushed the faucets. You should test the chlorine residual level:
- a. Immediately.
  - b. In 10 minutes.
  - c. In 20 minutes.
  - d. In 30 minutes.
  - e. In one hour.
11. You are using the five-ppm tube while testing chlorine residual and have properly prepared the test solution. The color of the solution is a lighter shade of yellow than the yellow band on the tube. This means that the chlorine residual level of the water sample is \_\_\_\_\_ five ppm.
- a. Less than.
  - b. More than.
12. What is the purpose of flushing the faucets of the Lyster bag?
- a. To relieve the pressure inside the bag.
  - b. To remove debris and sediment.
  - c. To disinfect the inside parts of the faucets and to ensure that no unchlorinated water is trapped inside them.
  - d. To allow any undissolved calcium hypochlorite to escape.

13. You are disinfecting a one-quart canteen of water using iodine tablets. The water is not cold and is clear. How many tablets should you add to the water?
- a. 1.
  - b. 2.
  - c. 3.
  - d. 5.
14. You are going to disinfect a canteen of clear cool water using regular commercial bleach. You should add \_\_\_\_\_ of bleach to the water.
- a. Two drops.
  - b. Four drops.
  - c. One canteen capful.
  - d. One cup.

**Check Your Answers on Next Page**

## **SOLUTIONS TO EXERCISES, LESSON 2**

1. d (para 2-2c)
2. c (para 2-3a)
3. b (paras 2-6a(2), (3))
4. a (para 2-1a)
5. c (para 2-9g)
6. d (para 2-14a(1))
7. d (para 2-7)
8. b (paras 2-9c, 2-8b)
9. a (para 2-8a(5))
10. b (para 2-9f)
11. a (para 2-9g(7))
12. c (para 2-9e)
13. b (para 2-11c(1))
14. a (para 2-13b(1))

**End of Lesson 2**

## LESSON ASSIGNMENT

### SUBCOURSE MD0535

Communicable Diseases and Field Sanitation.

### LESSON 3

Field Food Service Sanitation.

### LESSON ASSIGNMENT

Paragraphs 3-1 through 3-14.

### LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 3-1. Identify the sanitary controls required for transportation, handling, storage, preparation, and serving of food in the field.
- 3-2. Identify can defects and select those defects that call for rejection.
- 3-3. Identify the necessary components of a mess kit "laundry" and the proper method of setting them up.
- 3-4. Determine the required number of mess kit "laundries" for a given troop strength.

### SUGGESTIONS

After studying the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

## LESSON 3

### FIELD FOOD SERVICE SANITATION

#### Section I. FOOD INSPECTION AND STORAGE

##### 3-1. IMPORTANCE OF GOOD FOOD SERVICE SANITATION

Food, even the most appetizing, can cause illness if it has become contaminated with disease-producing organisms through improper handling. Outbreak of food poisoning, dysentery, and typhoid fever may result from unsanitary practices in kitchens and dining halls. Persons who handle food must always maintain the highest standards of personal hygiene and sanitation.

##### 3-2. RESPONSIBILITIES FOR FOOD SANITATION

a. **Commander.** Commanders are responsible for the sanitary control of food served as well as for the enforcement of sanitary regulations and orders that govern the handling and serving of food. The commander appoints a dining facility officer. This officer has the duty of supervising food service operations within that command.

b. **Army Medical Department.** The Army Medical Department (AMEDD) is responsible for inspecting food and for making sanitary inspections of the food service facilities and operations.

##### 3-3. FOOD INSPECTION

All food used in the Army is inspected several times prior to its being issued to a unit. Specially trained AMEDD personnel, under the supervision of the Veterinary Corps, perform these inspections. If any sign of spoilage is noticed at the kitchen, the food must again be inspected and must pass the approval of a representative of the AMEDD before it may be prepared for serving. Foods grown locally are not used unless the senior medical advisor approves their use.

##### 3-4. INSPECTION OF CANNED FOODS

a. **Canned Defects.** All types of canned foods should be examined carefully for faulty containers. Spoilage of food within a can is usually indicated by some major deformity or abnormality in the can itself--rust, large dents, punctures, leakage around seams, or swelling. Most defective cans are easy to detect. Cans with major defects should be rejected unless they are inspected by qualified personnel of the AMEDD and the inspection shows the contents to be safe for consumption. Normal cans have sunken ends. Three common types of major can defects are listed below.

(**NOTE:** Dents in cans that result from handling are usually not major defects if the dent is not in the seam of the can.)



(1) Leaker. A "leaker" is a can that allows air to enter the can or the contents to leak out. When air has entered a can, the ends will no longer be curved in (sunken), but will have flattened. The contents of such a can must be considered spoiled and must be discarded. Cans with large dents on the seam may become leakers and should also be rejected.

(2) Springer. A "springer" is a sealed can which has one end bulging. Pressing on the bulging end with the thumb will cause the other (sunken) end to bulge out (spring or pop). This condition is usually due to gas-producing bacteria in the food that were not destroyed in the canning process.

(3) Sweller. This is a can that bulges at the sides and ends. Like springers, swellers are usually caused by gas-producing bacteria.

b. **Contents**. The outsides of cans that contain food must be protected from contamination by filth, flies, rats, and other vermin. Such contamination could be transferred to the food when the can is opened and the contents are removed. Canned food that has an abnormal odor, taste, or appearance must not be used without the approval of a veterinary or medical officer.

### **3-5. HANDLING AND STORAGE OF FOOD**

Food must be protected from sun, heat, dust, insects, rodents, and any other agent that might cause contamination or the growth of disease-producing organisms. Perishable foods such as fresh vegetables, meats, dairy products, and bread require special protection.

a. **Transportation of Subsistence**. Vehicles used for transporting foods should be covered. They must be kept clean and never be used for transporting garbage, trash, petroleum products, or other materials that might result in the food being contaminated.

b. **Inspection Upon Arrival**. Immediately upon arrival, food received at the kitchen from the issuing point should be inspected by the unit food service sergeant or by another responsible individual. Food that appears unwholesome should be referred to a veterinary representative for an opinion as to its suitability for human consumption.

c. **Storage**. Foods accepted by the kitchen should be placed in storage as quickly as possible. Staple items should be arranged neatly on storage racks. Vegetables, such as potatoes and onions, are best kept in bins constructed of slats so spaced as to permit the circulation of air (figure 3-1). This will retard decay and spoilage.

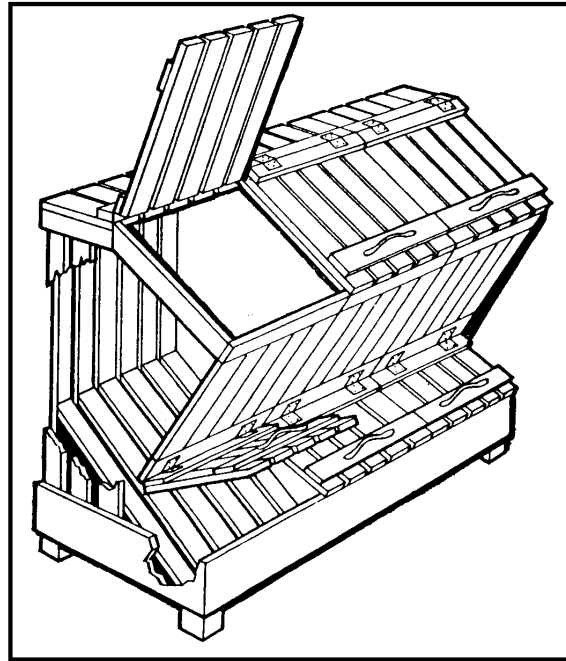


Figure 3-1. Vegetable bins.

d. **Refrigeration.** Foods such as meats, dairy products, and certain other perishable foods require refrigeration if they are not to be used immediately.

(1) Mechanical. Mechanical refrigeration units are to be used when available. The temperature of freezers or freezing compartments of refrigerators in which frozen foods are stored must be maintained at 10° F or lower. Ice cream should be stored at 0° F or below. The temperature of the refrigerators in which unfrozen perishable foods are stored should be maintained at between 32° F and 40° F. The cooling efficiency of a refrigerator is increased by placing the food items so that the cold air from the cooling unit can circulate freely between them, by defrosting the refrigerator regularly, and by keeping the refrigerator door closed to the maximum extent possible.

(2) Iceboxes. Iceboxes or ice chests must be used when mechanical refrigeration is not available. Ice for this purpose must be obtained from a source approved by the AMEDD. The drains for such boxes must not be connected directly to the sanitary sewers as this could permit a backup of sewage into the box. As in mechanical refrigeration, the arrangement of food items in iceboxes should be such as will allow the free circulation of cold air. Usually, it is impossible to maintain a temperature of 40° F in iceboxes, but every effort should be made to keep the temperature as low as possible.

## Section II. FOOD PREPARATION AND SERVING

### 3-6. GENERAL

While it is desirable to make food as attractive as possible, it is more important to assure sanitary methods of preparation, handling, and serving. High standards of sanitary methods used in the handling of food and high standards of personal cleanliness and health in all aspects of the food service program must be maintained. Conveniently located, well-kept handwashing facilities for all food service personnel are an absolute necessity in every Army kitchen. Handwashing after going to the latrine must become a fixed habit and continually enforced by supervisors. Personnel who are to be assigned as food handlers are given a physical examination by a physician. Those who have communicable diseases or who are known to be carriers of such diseases are not assigned as food handlers. Even more important than this initial screening is the supervisor's daily on-the-job check of food-handling personnel for signs of illness or infection. This inspection should be as thorough enough to make certain that food handlers have no obvious signs of illness or infection; that their hands, fingernails, and clothing are clean; and that they have no boils, rashes, or infections. Food handlers should be instructed to report sore throats, colds, coughs, diarrhea, vomiting, and other symptoms of infection and disease. Questionable cases are to be referred to the senior medical advisor without delay.

### 3-7. RAW FRUITS AND VEGETABLES

a. **General.** Fruits and vegetables that are to be eaten raw must be washed thoroughly in potable water before serving. This applies especially to leafy and root vegetables such as lettuce, celery, cabbage, carrots, radishes, and fresh onions since these vegetables are usually contaminated with organisms from the soil. In some areas of the world, human waste is used as fertilizer. In such areas and in areas where intestinal diseases are expected to be prevalent, locally produced fruits and vegetables may not be consumed raw except with the approval of the command medical authority. Under such conditions, hard-skinned fruits and vegetables with intact surfaces may be used only after being thoroughly washed with potable water and soap or detergent, rinsed in potable water, and peeled. Other fruits and vegetables, including leafy vegetables, may be served raw if thoroughly washed in potable water with soap or detergent and then disinfected by one of the following methods.

b. **Chemical Disinfection.** Chemical disinfection may be performed in the following manner.

(1) Trim the outer bruised or torn leaves of vegetables, but do not cut or peel fruits and vegetables before disinfecting them.

(2) Wash the produce thoroughly in a solution prepared by dissolving one package (4.77 ounces) of food service disinfectant in 20 gallons of water (preferably warm water) according to the instructions on the package.

(NOTE: In the absence of food service disinfectant, disinfection may be accomplished by soaking for 30 minutes in a 250 ppm chlorine solution. Refer to the chart in figure 3-2.)

DISINFECTING AGENT AND AMOUNT	AMOUNT OF WATER REQUIRED FOR A SOLUTION OF:		
	50 ppm	100 ppm	250 ppm
1 Level Mess Kit Spoonful Calcium Hypochlorite (0.4 oz)	42 gal	21 gal	8 gal
5 Level Mess Kit Spoonfuls 5% Bleach (3.2 fl oz)	25 gal	12.5 gal	5 gal
1 Level Mess Kit Spoonful 5% Bleach (0.6 fl oz)	5 gal	2.5 gal	1 gal
1 Ampule Calcium Hypochlorite (0.5 g)	7.4 qt	3.7 qt	1.5 qt

Figure 3-2. Table for preparation of disinfecting solutions.

(3) Remove the produce from the wash solution and immerse it in another solution prepared in the same way as was the solution in paragraph (2) above. Leave the produce in this solution for 10 minutes and stir it occasionally to ensure that the surfaces are kept thoroughly wet.

(4) Remove the produce from the solution and rinse it thoroughly in potable water.

(5) Dispose of the food service disinfectant solutions. These solutions are not to be used more than once. Fresh solutions must be prepared for each batch of produce.

c. **Disinfection by Boiling.** An alternate method of disinfecting produce is by dipping it in boiling water for 15 seconds or by immersing it in 160° F water for one minute. Placing the produce in net bags will make dipping and draining quick and easy. Since the water must come in contact with all parts of the produce, each batch to be dipped should be small and loosely arranged. Leafy vegetables should be treated by chemical disinfection (paragraph a above) since boiling water will wilt the outer leaves.

### 3-8. MILK

Only pasteurized fluid milk and fluid milk products from an approved source may be used or served. In the field, milk and fluid milk products are served in individual, single service, disposable containers of a pint or less. Such containers must be the original unopened containers in which the product was packaged at the milk plant. When field dining facilities are equivalent to garrison dining facilities (mechanical

refrigeration, running water, fly control, and so forth), milk may be served from approved bulk dispensers. All unused milk left in an opened container must be disposed of as food waste.

### **3-9. SALADS, HASH, AND CHOPPED MEATS**

Hash and chopped meats are foods that are ideal for the growth of bacteria. Salads containing eggs or milk also furnish excellent conditions for the growth of bacteria. Whenever possible, touching food with the hands should be avoided. It is easy to learn to handle food with utensils (spoons, forks, tongs, or other suitable devices) and so avoid direct contact with the food. Food service personnel who prepare salads should take special care to cleanse their hands with soap and hot water before they handle the ingredients. Foods that readily support bacterial growth (salad dressings, ham and chicken salads, hash, cream fillings, cream sauces, custards, and so forth) should be prepared as shortly before serving time as possible and never more than three hours before serving. Foods of this nature must not be held over from one meal to another or left standing at room temperature. Sandwich fillings for box lunches should not be made with spreads containing ground meat or chopped egg.

### **3-10. COOKING TEMPERATURES**

The best safeguards against getting sick from food are thorough cooking and immediate serving. With the exception of those foods that contain chemical poisons or staphylococcus toxin, food can usually be made safe to eat by cooking the food at the proper temperature for the proper length of time. Recommended cooking times and temperatures for meat products are given below.

a. **Beef.** Cooking time and temperature for meat products must ensure that the center of the meat is adequately cooked. For beef, this can be achieved by roasting it at an oven temperature of 325° F until a meat thermometer inserted into the middle of the thickest part of the meat registers 140° F (rare), 160° F (medium), or 170° F (well done).

b. **Pork.** Pork should be roasted at an oven temperature of 350° F until a meat thermometer inserted into the thickest part of the meat registers at least 150° F. (An internal temperature of 170° F is recommended for fresh pork to provide a uniformly cooked product.) The cooking temperature for pork is especially important because of the danger of trichinosis, a disease caused by tiny parasitic worms. Adequate cooking of pork products will destroy any of these parasites present in the meat.

c. **Poultry.** Poultry and dressing must be cooked throughout to a minimum internal temperature of 165° F with no interruption of the initial cooking process. All dressings are cooked separately from the meat--poultry is not to be stuffed.

### 3-11. LEFTOVERS

Meals should be planned so that there will be a minimum of leftover food. In the absence of mechanical refrigeration, food left from a meal is not to be held until the next meal. Items held at unsafe temperatures or which have been placed on the serving line are not to be held over for reuse and must be discarded as waste. Prepared refrigerated items that have not been placed on the serving line may be retained for no more than 24 hours. Prepared hot items may be retained for 24 hours if chilled rapidly and maintained at a product temperature of 45° F or below; however, this procedure is seldom practicable in the field.

## Section III. CLEANING OF FACILITIES AND EQUIPMENT

### 3-12. CLEANING FIELD DINING FACILITIES

A dirty, unsightly dining facility is usually an indication of poor sanitation throughout the establishment. If personnel can be trained to keep the kitchen and dining area neat and clean, they can also be trained in the vital matter of sanitary food handling. Food particles left on dishes, mess kits, and other items can become a breeding place for disease-producing organisms.

a. **Kitchen.** Tables, stoves, and ice chests must be kept clean. Covered cans should be placed at convenient places in the kitchen to collect wastes. If the kitchen is in a tent, the ground and surrounding area must be well policed.

b. **Storage.** Supplies should be stored above the ground on platforms about a foot high. These platforms can be made of scrap lumber.

c. **Ice Chests.** Ice chests must be cleaned frequently with soap and hot water. A sour smell may develop from spilled foods.

d. **Tables.** Tables, if used, should have solid tops without cracks or crevices in which food particles can lodge. If material for solid tops cannot be found, tabletops can be made of smooth boards. When this is done, the center board should be removable for easier cleaning. Kitchen and dining tables should be scrubbed immediately after using. The presence of old food particles promotes the growth of bacteria and gives a sour, unpleasant odor to the establishment.

e. **Ranges.** Ranges should be cleaned after each meal to prevent dirt and grease from accumulating and being baked onto the metal.

### 3-13. CLEANING COOKING AND SERVING UTENSILS

Cooking and serving utensils must be cleaned and disinfected after each use. They should be washed using hot water whenever possible. If sufficient hot water is not available, chemical disinfection agents may be used. These methods are given below:

**a. Using Hot Water for Disinfecting.**

- (1) Scrape utensils to remove food particles.
- (2) Wash in warm water containing soap or other detergent.
- (3) Rinse in clear, hot, potable water.
- (4) Give a final disinfecting rinse in clear hot (180° F) potable water for one minute or rinse with boiling water.

**(NOTE:** If the items are being rinsed with hot water and a thermometer is available, check the temperature of the water.)

- (5) Dry utensils in the open air and protect against dust, splash, and other contamination.

**b. Using Disinfecting Solution.**

- (1) Scrape utensils free of food particles.
- (2) Wash the utensils in the hottest water available containing soap or detergent.
- (3) Rinse in the hottest clear potable water available.
- (4) Rinse in a disinfecting solution prepared by adding one package of food service disinfectant to 25 gallons of water according to the instructions on the package. When food service disinfectant is not available, immerse for at least one minute in a sanitizing solution containing at least 50 ppm chlorine residual (see figure 3-2) at a temperature of not less than 80° F. Fresh solution must be made for rinsing and sanitizing utensils for each 100 persons.
- (5) Rinse again in another separate disinfecting solution prepared in the same manner as the solution described in paragraph (4) above.
- (6) Dry in the open air and protect against dust and other contamination.

**3-14. CLEANING INDIVIDUAL MESS KITS**

**a. Mess Kit Laundry Setup.** In the field, each individual normally eats from his own mess kit. Proper washing is important; otherwise, food particles will remain and become breeding places for disease organisms. Three galvanized (GI) 32-gallon cans or other similar containers placed in a row are used to clean mess kits (figure 3-3). Enough water is placed in each can to allow at least one quart of water per man. Large units may require several washing lines. The first can contains hot (150°F) soapy

water. The second and third cans contain clear hot (180°F) water. The entire setup, commonly referred to as a mess kit laundry, is placed over a soakage pit (paragraph 4-4) to take care of splash and overflow. A long-handled washbrush and a garbage can or pit are also needed.

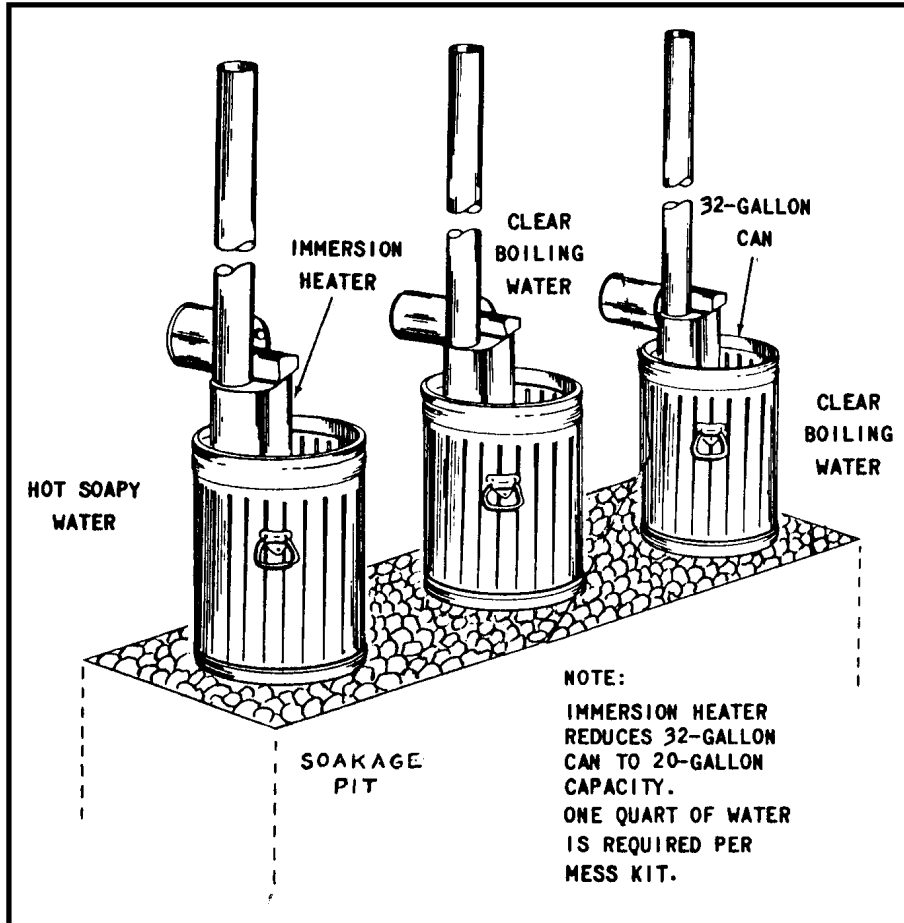


Figure 3-3. Mess kit washing setup.

b. **Immersion Heater.** An immersion heater is normally used to heat the water in a mess kit laundry.

(**CAUTION:** Do not operate heater within a building, tent, or other enclosed place unless exhaust fumes are piped outside.)

The heater is fired by gasoline. It consists of a doughnut-shaped combustion chamber and a stack assembly welded together. The unit is placed directly in the water that is to be heated. The unit displaces approximately 12 gallons of water; therefore, an immersion heater reduces the 32-gallon capacity of a standard GI can to 20 gallons. This will accommodate 80 persons. If the strength of a unit exceeds 80, an additional wash line must be set up for each 80 persons or fraction thereof.



**c. Procedure.**

(1) Scrape the food scraps remaining in the mess kit into a garbage pit or garbage can.

(2) Wash the kit in the first container of hot soapy water using a long-handled brush.

(3) Rinse the kit in the second can of clear, hot (180° F or higher) water by dipping it up and down several times. (If a thermometer is not available to determine the temperature of the water, heat the water until it boils and keep the water boiling throughout the washing period.)

(4) Disinfect the kit by putting it in the third container of clear, hot (180° F or higher) water for 30 seconds. (If a thermometer is not available to determine the temperature of the water, heat the water until it boils and keep the water boiling throughout the washing period.)

(5) Remove the kit and shake it to remove the excess water. Allow it to dry in the air. Replace the cover to keep out dust and vermin.

**d. Alternate Procedure When Hot Water Is Not Available.**

(1) Mess kit laundry setup. When hot water is not available, the mess kit laundry is set up as follows:

(a) One can of the warmest water available and with soap or detergent added.

(b) Two cans of disinfecting solution. Each can is prepared by dissolving one package of food service disinfectant in 25 gallons of water.

(c) A new solution must be prepared after disinfecting 100 mess kits or a separate three-can setup established for each 100 persons or fraction thereof.

(2) Procedure.

(a) Scrape the food scraps remaining in the mess kit into a garbage pit or garbage can.

(b) Wash the kit in the first can of warm soapy water using a long-handled brush.

(c) Rinse the kit in the second can by dipping the kit several times into the disinfectant solution.

(d) Rinse the kit in the disinfectant solution in the third can.

e. **Disinfection Prior to Use.** If a mess kit becomes soiled between meals, it should be cleaned and sterilized before use, preferably by immersion in boiling water. In addition to killing any bacteria present and removing dust, the boiling water heats the mess kit and helps to keep the food warm.

**Continue with Exercises**

### EXERCISES, LESSON 3

**INSTRUCTIONS:** The following exercises are to be answered by circling the letter of the response that best answers the question or best completes the incomplete statement.

After you have completed all of the lesson exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. A can of food has a bulge on the bottom but no bulge on the top. When you push in on the bottom, the end goes back to its normal sunken shape and the top of the can bulges. What is this can defect called?
  - a. Leaker.
  - b. Popper.
  - c. Springer.
  - d. Sweller.
  - e. None of the above.
  
2. Should you eat the food in the can described in exercise 1 or reject the canned food?
  - a. Use the food.
  - b. Reject.
  
3. Which of the following would be the most appropriate vehicle for transporting food?
  - a. A truck previously used to haul oil and gasoline.
  - b. A truck previously used to haul trash and garbage.
  - c. A covered trailer.
  - d. An uncovered trailer.

4. Ice cream should be stored at:
  - a. Minus 10° F or below.
  - b. 0° F or below.
  - c. 10° F or below.
  - d. 20° F or below.
  - e. 30° F or below.
  
5. Beef should be cooked until the internal temperature of the thickest part of the meat is at least:
  - a. 120° F.
  - b. 140° F.
  - c. 160° F.
  - d. 170° F.
  
6. You are preparing water to be used in washing and disinfecting vegetables using cans holding five gallons of water each. How much bulk hypochlorite should you add to five gallons of potable water in order to obtain the desired chlorine residual?
  - a. 0.25 oz.
  - b. 0.4 oz.
  - c. 0.64 oz.
  - d. 3.2 oz.

7. Which one of the following is a dangerous practice that should not be allowed in the field?
- a. Serving milk in individual half-pint containers.
  - b. Preparing dressing by stuffing the dressing inside a turkey and cooking the turkey and dressing together.
  - c. Cooking pork to a minimum internal temperature of 160°F.
  - d. Using tables in dining facilities made of smooth boards with the tabletop made so that the middle board can be removed.
8. You are using disinfectant as an alternative to hot water in a mess kit laundry. One hundred twenty people will be using the facilities. How many separate setups (three cans containing 25 gallons of water each) will you need? (No can is to be emptied and refilled with fresh solution.)
- a. 1.
  - b. 2.
  - c. 3.
  - d. 4.

**Check Your Answers on Next Page**

### SOLUTIONS TO EXERCISES, LESSON 3

1. c (para 3-4a(2))
2. b (para 3-4a)
3. c (para 3-5a)
4. b (para 3-5d(1))
5. b (para 3-10a)
6. a (para 3-7b(2); figure 3-2)

$$\frac{0.4 \text{ oz}}{8 \text{ gal}} = \frac{x \text{ oz}}{5 \text{ gal}}; (0.4)(5) = 8(x); 2 = 8x; \frac{2}{8} = x; x = 0.25$$

7. b (para 3-10c)
8. b (para 3-14d(2))

$$120 \div 100 = 1.2 \text{ (round up to 2)}$$

**End of Lesson 3**

## LESSON ASSIGNMENT

### SUBCOURSE MD0535

Communicable Diseases and Field Sanitation.

### LESSON 4

Field Waste Disposal.

### TEXT ASSIGNMENT

Paragraphs 4-1 through 4-24.

### LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 4-1. Identify the five types of waste.
- 4-2. Given a particular type of waste and various disposal methods, select the method(s) that is/are appropriate.
- 4-3. Identify features of construction, operation, maintenance, and closure of commonly used field waste disposal devices.
- 4-4. Compute the number or amount of facilities needed based upon the number of people to be served.
- 4-5. Identify procedures for making improvised sanitary devices.

### SUGGESTIONS

After studying the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

## LESSON 4

### FIELD WASTE DISPOSAL

#### Section I. INTRODUCTION TO WASTE DISPOSAL

##### 4-1. DEFINITIONS

"Waste" is a general term covering all types of refuse resulting from the living activities of humans or animals.

- a. **Human Waste.** Human waste refers to feces and urine.
- b. **Liquid Waste.** Liquid waste includes bathing water, wash water, and liquid kitchen wastes such as grease.
- c. **Garbage.** Garbage includes solid food wastes.
- d. **Infectious Waste.** Infectious waste is refuse containing communicable disease organisms and/or offensive materials such as soiled dressings.
- e. **Rubbish.** Rubbish includes combustible and noncombustible solid wastes not included in one of the above.

##### 4-2. MEDICAL IMPORTANCE OF WASTE DISPOSAL

a. Large amounts of wastes of all kinds are produced under field conditions. If these wastes are not removed, a camp or bivouac will soon become a smelly, filthy dump. Filth-borne diseases such as dysentery, typhoid, cholera, and plague might become prevalent. Flies, rats, and other vermin would increase and add to the individual's discomfort as well as endanger his health. Even with the relatively good sanitation maintained in the American Army camps of World War II, records show a total of nearly one million hospital admissions for filth-borne diseases.

b. Whenever possible, units in the field should use portable toilets and other temporary waste collection containers which can be emptied into approved disposal facilities upon the unit's return to garrison. However, this is not always possible--particularly in overseas areas. The disposal methods discussed in this lesson should be considered emergency methods to be used only when it is not possible to use approved waste disposal facilities. Since the method used depends on the military situation and unit location, several means of disposal are discussed in this lesson. Under field conditions, burial is the most commonly used means of waste disposal.



#### **4-3. FIELD SANITATION TEAM**

Unit commanders are responsible for the disposal of waste from their unit areas. When waste disposal facilities are not otherwise provided, the commanding officer must arrange for the construction and operation of such facilities. A unit field sanitation team appointed by the commander will usually supervise the construction and operation of these facilities.

- a. The field sanitation team is strictly an advisory team. It is not a labor force. Each unit is responsible for constructing and operating its own field waste disposal devices.
- b. The team consists of at least two persons, at least one of which is a noncommissioned officer. A medical specialist may serve as a member of such a team.

### **Section II. IMPROVISED SANITARY DEVICES**

#### **4-4. SOAKAGE PIT**

A soakage pit is a device used to maintain a sanitary condition around mess kit wash lines, improvised handwashing and showering facilities, and other situations where water or other liquids may be spilled. A soakage pit assists in the natural capability of the soil to absorb liquids. It is constructed by digging a square or rectangular pit (pits are usually four feet square and four feet deep) and filling the hole with rocks, bricks, broken bottles, or similar material that will act as a filter. The filter material should be arranged (graded) so that the smaller stones or gravel are at the top and the larger objects are at the bottom. The actual size of the soakage pit depends upon the quantity of water that will flow into the pit.

#### **4-5. HANDWASHING DEVICES**

One of the most common means of transmitting intestinal diseases is contaminated hands. The importance of frequent and thorough handwashing cannot be overemphasized. To encourage and enforce this practice, effective handwashing devices should be conveniently located near field kitchens, field latrines, and other locations where they may be appropriate within the area. Any device (container) that holds water can be used as a handwashing device. The simplest handwashing devices may be made from five-gallon water cans or from used number 10 size food cans.

- a. **Five-Gallon Cans.** When using five-gallon water cans, punch a hole in the cap and suspend the can from a support. By having the cans arranged as shown in figure 4-1, they may be tipped to permit a flow of water.

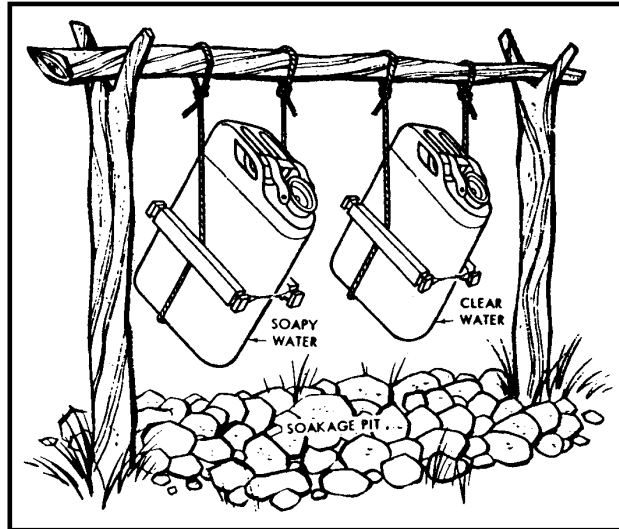


Figure 4-1. Handwashing device using five gallon water cans.

b. **Food Cans, First Method.** One method is to punch four small holes in a number 10 can and mount this can as illustrated in figure 4-2 A. Water is dipped from the large container and poured into the number 10 can. The water then flows from the number 10 can in four streams of water. The large container of water should be covered when this device is not in use to prevent mosquitoes from using the water for breeding.

c. **Food Cans, Second Method.** Another method is to arrange number 10 size food cans as shown in figure 4-2 B. Wooden rods are run through the tops of the cans and the ends of the rods are supported by forked sticks. The handles are made from small sticks that have had one end split. These are fitted over the back of the cans. As these cans hold only small amounts of water, the water must be constantly replenished.

#### 4-6. SHOWER FACILITIES

Shower facilities in the field are important not only from the standpoint of personal hygiene, but also in the interest of maintaining good morale in a unit. Whenever possible, support should be requested from a quartermaster bath detachment. The detachment can provide a portable eight-showerhead bath unit capable of providing hot showers and a clothing exchange service for 2,000 to 3,000 troops per week. Because such support is not always available and because a weekly shower is not adequate for active troops in warm weather, units should make every effort to improvise showers in the field. Figure 4-3 shows two methods of improvising showers using 55-gallon drums. During hot weather, heat from the sun may help remove the chill from shower water. Caution should be used when taking showers in the afternoon in hot climates since the water may reach scalding temperatures. Painting the containers a dark color will help increase absorption of heat from the sun. In the winter or when large amounts of hot water are needed, heating must be accomplished by another method such as by means of an immersion heater.

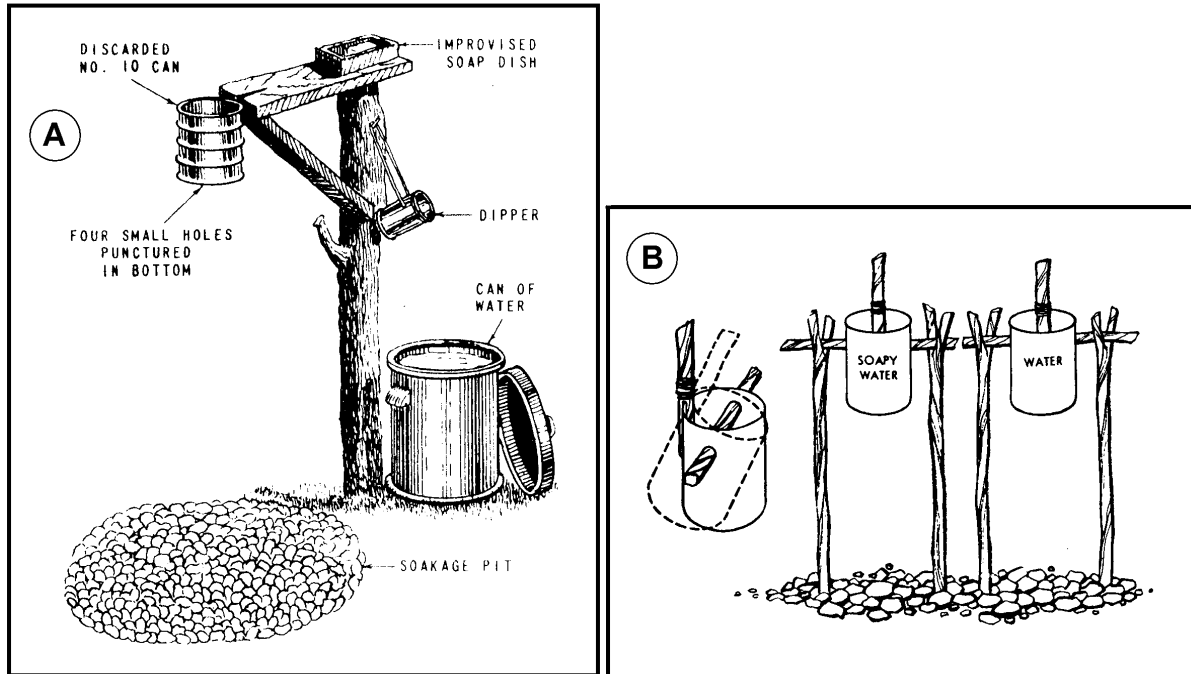


Figure 4-2. Handwashing devices using number 10 cans.

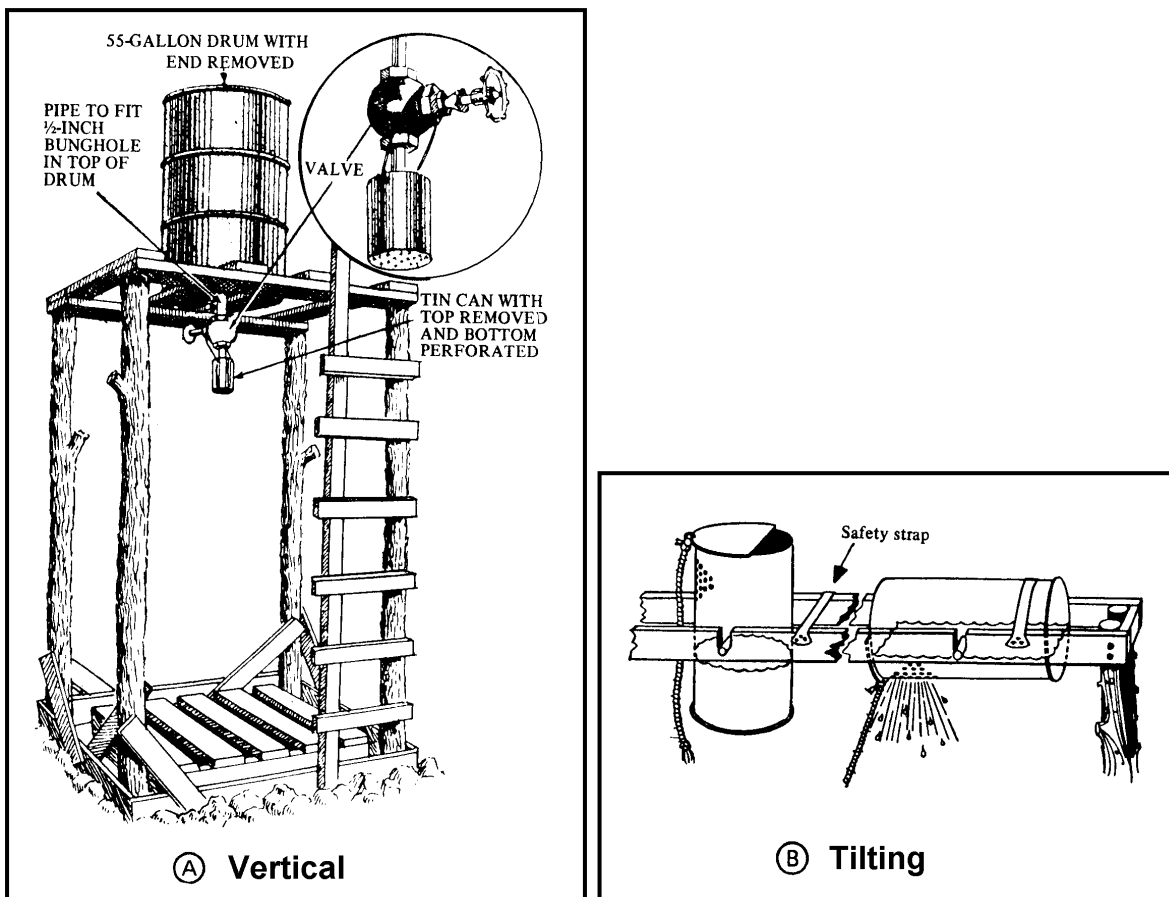


Figure 4-3. Improved shower units.

## Section III. HUMAN WASTES

### 4-7. LATRINES

The methods of human waste disposal will vary with the situation. When no other provisions are available, military units must adopt methods discussed below.

a. **March.** On the march, the "cat hole" latrine is used. The individual digs a hole about a foot deep, defecates, and then replaces the earth over the feces.

b. **Bivouac.** In bivouacs of about one to three days and in overnight camps, urine and feces are disposed of by the use of straddle trenches (paragraph 4-10).

c. **Camp.** In temporary camps, deep pit latrines and urine soakage pits are constructed. Straddle trench latrines may be used until the construction of deep pit latrines has been completed. Where the construction of deep pit latrines is not practicable, some of the other devices such as mound, bored-hole, pail or burn-out latrines may be used. Whatever the type used, the unit is responsible for its own latrine construction, maintenance, and closure.

### 4-8. CONSTRUCTION OF LATRINES

The following general rules apply to all latrine construction.

a. **Select Type.** In determining the type of latrines to be constructed, consider the length of stay, the ground water level, and the soil conditions. To protect the ground water from contamination, do not extend the depth of a latrine pit or trench to the underground water level.

b. **Determine Number of Facilities Needed.** A sufficient number of facilities should be constructed so that the latrines can accommodate four percent of the male population and six percent of the female population at the same time.

(NOTE: Remember that male latrines and female latrines are separate facilities.)

Enough urinals (paragraph 4-16) should be constructed to accommodate five percent of the male population at one time.

c. **Select Site.** To make sure that food and water will be protected from contamination, latrines should be built at least 100 yards from the dining facility and 100 yards from the nearest water source. The latrine should not be dug below the water level in the ground nor in a place where it may drain into a water source. Usually, latrines are built reasonably near the end of the unit area for easy access. Latrines should be lighted at night if the military situation permits. If lights cannot be used a piece of cord or tape may be fastened to trees or stakes to serve as a guide to the latrine.

d. **Provide Shelter and Privacy.** A canvas or brush screen should be placed around each latrine or the latrine may be enclosed within a tent. In cold climates, this shelter should be heated.

e. **Take Sanitary Precautions.** The screen or the tent should have a drainage ditch dug around its edges to prevent water from flowing over the ground into the latrine. The shelters should be sprayed daily with an approved insecticide for fly control. Using lime in the pits and burning out the pit contents, except in burn-out latrines (paragraph 4-15), are not effective methods of fly and odor control and are not recommended.

f. **Provide Handwashing Devices.** On the outside of each latrine enclosure, a simple handwashing device (paragraph 4-5) should be installed. This device should always be kept filled with water and should be easy to operate.

g. **Police Area.** Latrines should be policed every day. Certain unit personnel should be assigned the responsibility of ensuring that the latrines are being properly maintained.

#### **4-9. CLOSING A LATRINE**

When a latrine has been filled to within one foot of the surface or when it is to be abandoned, it should be closed in the following manner in order to prevent any flies that may hatch in the closed latrine from getting out.

- a. Remove the latrine box, tent, and/or other structures.
- b. Spray the contents of the pit, the side walls, and the ground surface to a distance of two feet from the side walls with an approved residual insecticide.
- c. Fill the pit to the ground surface with successive, three-inch layers of earth. Pack each layer down and spray its surface with residual insecticide before adding the next layer.
- d. Mound the latrine pit over with at least one foot of dirt and spray again.
- e. If the tactical situation permits, mark the location of the latrine with a sign. The sign should state "CLOSED LATRINE," the type of pit, and (in nonoperational areas) the unit designation. Marking the closed latrine warns following units of its presence.

#### **4-10. STRADDLE TRENCH LATRINE**

A straddle trench latrine is dug one foot wide, two and one-half feet deep, and at least two feet long. This will accommodate one person at a time. At least eight feet of trench (four straddle trench latrines) are needed for each 100 men (figure 4-4). At least

12 feet of trench (six straddle trench latrines) are needed for each 100 women. The trenches should be at least two feet apart. There are no seats in this type of latrine, but boards may be placed along both sides of the trench to provide better footing. Toilet paper should be placed on suitable holders and protected from bad weather by a tin can or other covering. Handwashing devices and urinals should be located near the latrine. The earth removed in digging each trench is piled at the end of the trench and a shovel or paddle is provided. This is done so that each person can promptly cover his excreta and toilet paper. When the unit is ready to leave the area or when the straddle trenches are filled to within one foot of the surface, the trenches are closed in the manner described in paragraph 4-9.

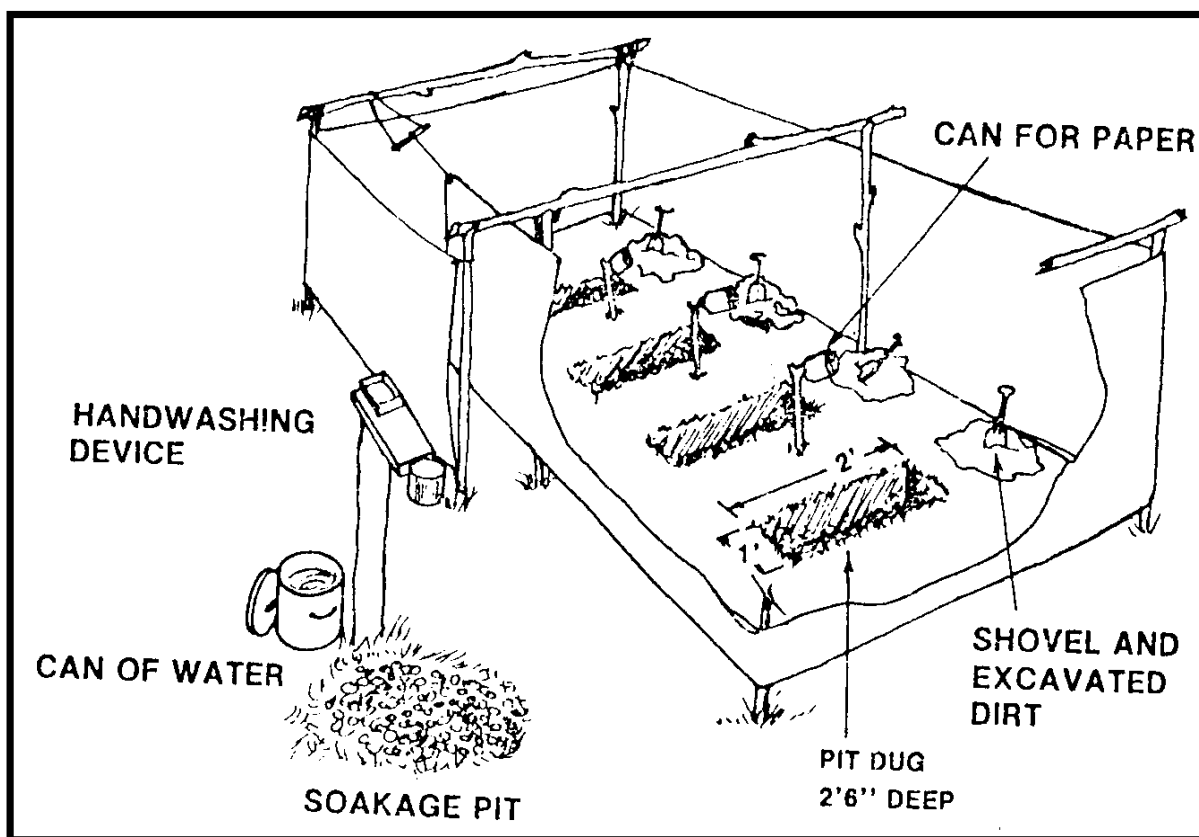


Figure 4-4. Straddle trench latrines (tentage covering cut away).

#### 4-11. DEEP PIT LATRINE

a. **Latrine Box.** The deep pit latrine is used with a latrine box (fig 4-5). The standard type box provides two seats and is four feet long and two and one-half feet wide at the base. A unit of 100 men requiring eight feet of latrine space will need two latrine boxes. The holes should be covered with fly-proof self-closing lids. All cracks should be fly-proofed with strips of wood or tin nailed over them. A metal deflector should be placed inside the front of the box to prevent urine from soaking into the wood. A prefabricated two-seat latrine box is available through normal supply channels. Four-seat latrine boxes can be constructed by units if desired.

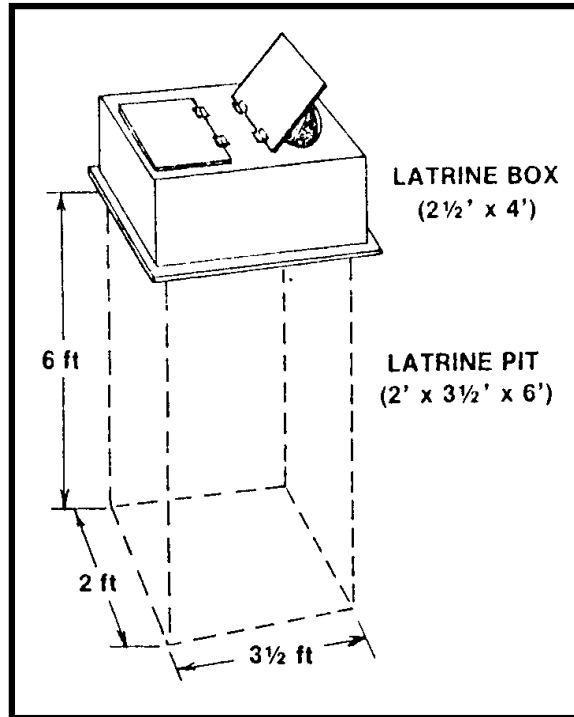


Figure 4-5. Deep pit latrine.

b. **Latrine Pit.** The pit is dug two feet wide and three and one-half feet long. This will give the latrine box three inches of support on all sides. The depth of the pit will depend on the estimated length of time the latrine is to be used. As a rough guide, allow a depth of one foot for each week of estimated use plus one foot of depth for the dirt cover. Generally, it is not desirable to dig the pit more than six feet deep because of danger that the walls may cave in. Rock or high ground water levels often limit the depth of the pit. In some types of soil, a support of planking or other material for the sides may be necessary to prevent the wall from caving in. Earth should be packed tightly around the bottom edges of the box in order to seal any openings through which flies might gain entrance.

c. **Vent.** It is sometimes desirable to install a vent stack to release the moisture-laden gases of decomposition. This prevents condensate from forming under the lids. (The condensation could come in contact with an individual's back.) The vent stack should extend from the upper part of the pit to about six feet above the ground. The outside opening of the vent stack must be screened with wire (18-mesh or smaller) to prevent flies and other insects from gaining entrance to the pit.

d. **Maintaining the Latrine.** In order to prevent flies breeding in the pit and to reduce odors, it is necessary to keep the latrine box clean, the seat lids closed, and the cracks sealed. A good fly control program must also be maintained in the area. The box and the seats of the latrine should be scrubbed daily with soap and water. When required, the latrine should be closed in the manner described in paragraph 4-9.

## 4-12. MOUND LATRINE

A mound latrine (figure 4-6) may be used when a high ground water level or a rock formation near the ground surface prevents the digging of a deep pit. A dirt mound makes it possible to build a deep pit latrine and still not have the pit extending into the water or the rock. The number of mound latrines required is computed in the same manner as the requirement for deep pit latrines.

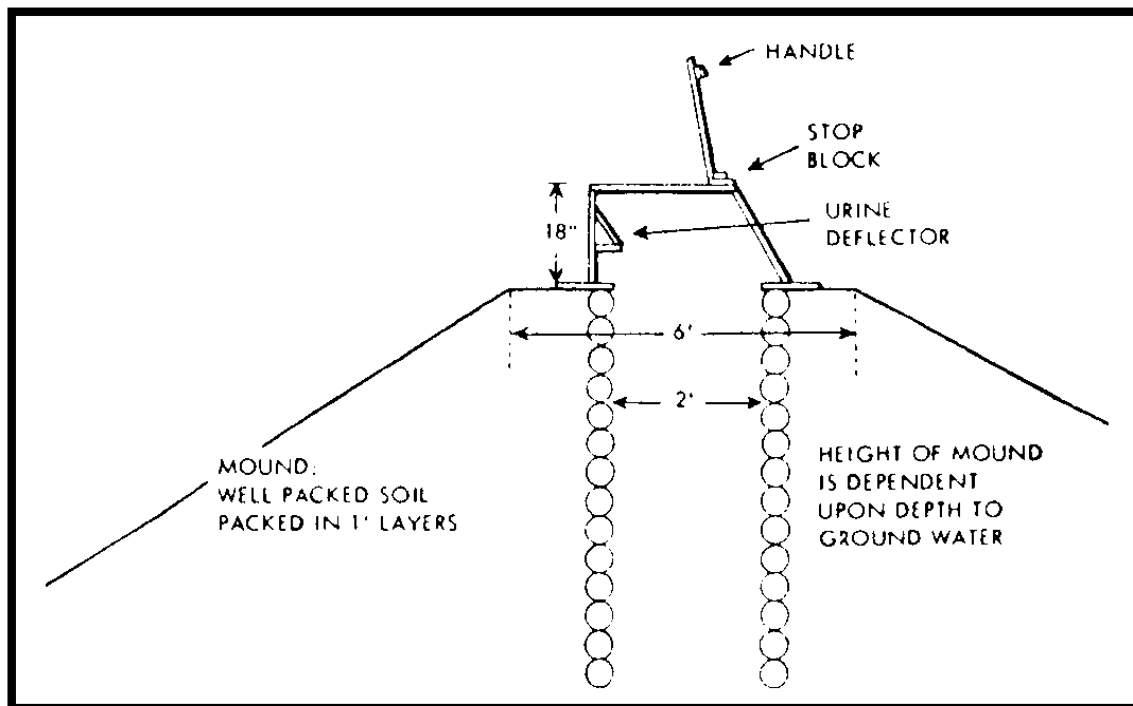


Figure 4-6. Mound latrine.

a. **Constructing the Latrine.** Form a mound of earth with a flat top that is at least six feet wide and six feet long. The mound should be constructed so that a two-hole latrine box may be placed on its top. The mound should be high enough to meet the pit's requirement for depth. The bottom of the pit should be at least one foot above the water or the rock level. Before the mound is built, the area where it is to be placed should be broken up or plowed to aid the seepage of liquids from the pit. The mound is then built in one-foot layers. The surface of each layer is roughened before the next is added. When the desired height has been reached, the pit is dug into the mound. It may be necessary to brace the walls with wood, sandbags, or other suitable material to prevent cave-ins. The size of the base of the mound will depend on the type of soil in the area. The base should be made larger if the slope is too steep. Steps going up the slope may be added if needed.

b. **Maintaining the Latrine.** The mound latrine should be fly-proofed in the same manner as the deep pit latrine. It is closed in the manner described in paragraph 4-9.



#### 4-13. BORED-HOLE LATRINE

A bored-hole latrine (figure 4-7) consists of a hole covered by a one-seat latrine box. The hole is about 18 inches in diameter and from 15 to 20 feet deep. A converted metal drum may be sunk into the ground for use as a box. Both ends of the drum are removed and a fly-proof seat cover, with a self-closing lid, is made to fit the top of the drum. This type of latrine is satisfactory for small units if the necessary mechanical equipment for boring the hole is available. Bored-hole latrines should be constructed so that there are four latrines per 100 males and six latrines per 100 females.

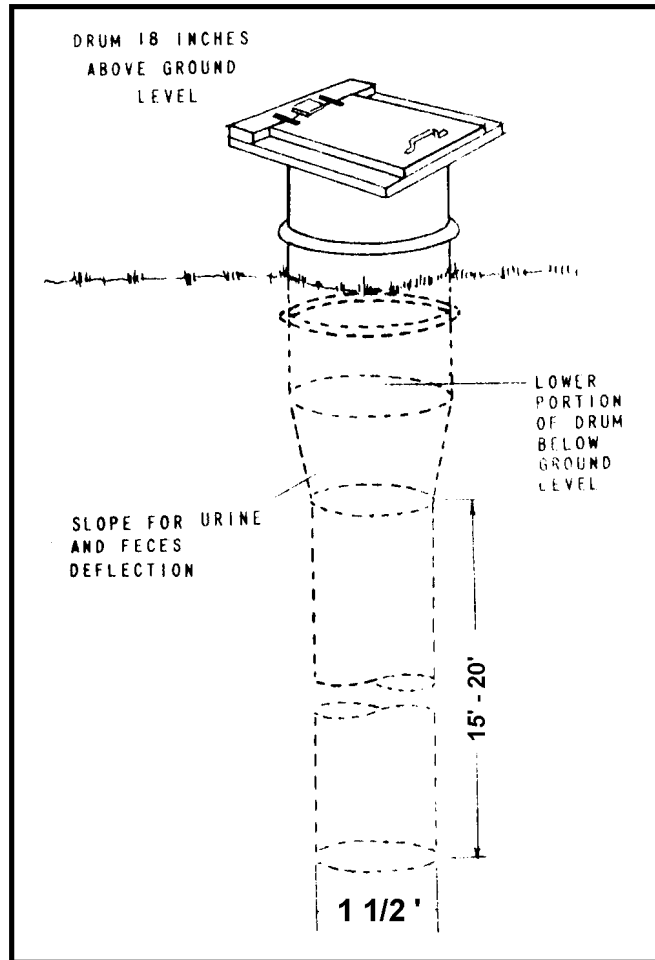


Figure 4-7. Bored-hole latrine.

#### 4-14. PAIL LATRINE

A pail latrine may be built when conditions are such that a dug latrine cannot be used (rocky soil, marsh, and so forth).

a. **Constructing the Latrine.** A standard type latrine box may be converted for use as a pail latrine by placing hinged doors on the rear of the box, adding a floor to the

box, and placing a pail under each seat. If the box is located in a building, it should be placed against the outer wall (figure 4-8). The seats and rear doors should be self-closing and the entire box made fly-proof. The floor of the box should be made of an impervious material (concrete, if possible) and should slope enough toward the rear to facilitate rapid drainage of washing water. A urinal may also be installed in the latrine enclosure with a drainpipe leading to a pail outside. This pail also should be enclosed in a fly-proof box.

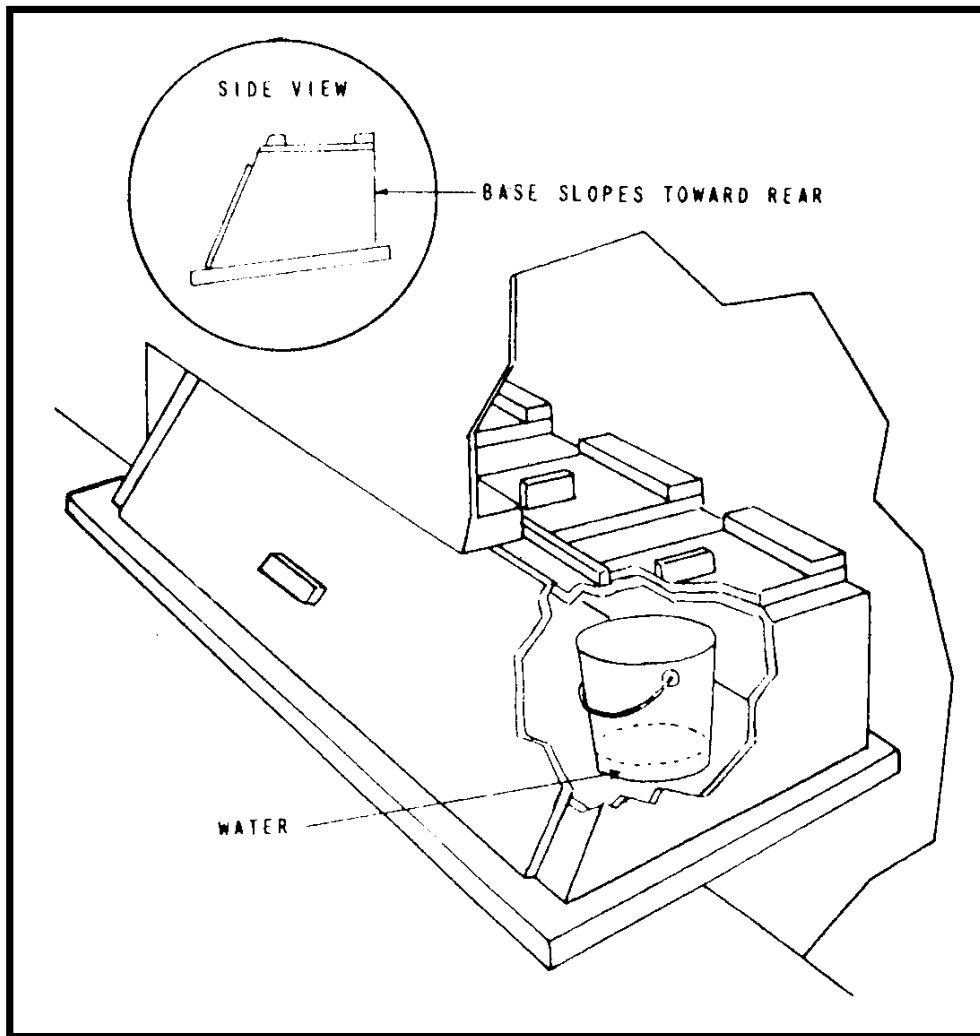


Figure 4-8. Pail Latrine in building (note four-seat latrine box).

b. **Maintaining the Latrine.** Pails should be cleaned at least once each day and oftener, if necessary. The contents may be burned, buried, or disposed of by other sanitary methods.

(NOTE: The waste will not usually be buried since the use of pail latrines indicates that the ground is not suitable for digging.)

Clean the pails before replacing them. When the pails are replaced, they should contain about one inch of water. If plastic bag liners are available, use them for the pails. The filled bags can be tied at the top and thus reduce the risk of spilling the contents.

#### 4-15. BURN-OUT LATRINE

The burn-out latrine may be used when the soil is hard, frozen, or rocky. In addition, it is particularly suitable to areas with high water tables. The burn-out latrine should not be used when air pollution regulations prohibit open fires or when the tactical situation prohibits the formation of thick, black, greasy plumes of smoke.

a. **Constructing the Latrine.** A burn-out latrine consists of a 55-gallon drum placed into the ground with the portion extending above the ground being a comfortable sitting height (about three-fourths of the drum should be below ground level with about one-fourth of the drum being above ground). A wooden seat with a fly-proof self-closing lid is placed on top of the drum. Figure 4-9 shows a cross-sectional view of the 55-gallon drum and the latrine seat.

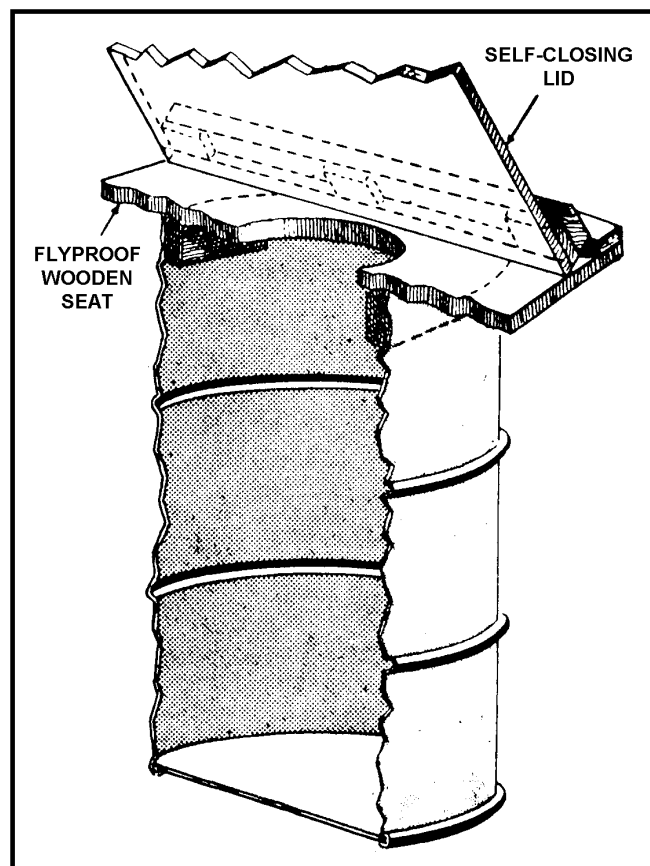


Figure 4-9. Burn-out latrine.

b. **Maintaining the Latrine.** The latrine is burned out daily by adding a fuel mixture (one quart gasoline to five quarts of diesel oil) to incinerate the fecal matter. Highly volatile gasoline or JP4 fuel should not be used because of its explosive nature. Welding handles to the sides of the drum will enable two men to carry the drum with ease. If two sets of drums are available, one set can be used while the other set is being burned out. This means that eight burn-out latrines should be used for each 100 males and 12 burn-out latrines should be constructed for each 100 females. Male personnel should urinate in a urine disposal facility rather than the burn-out latrine because burning the contents of a drum containing liquid requires additional fuel. After the burning, only a dry, odorless ash should remain. Sometimes two burnings are required to render a dry and odorless ash. The dry ash should be buried.

#### 4-16. URINE DISPOSAL FACILITIES

Urine disposal facilities should be provided to accommodate at least five percent of the male component of the command at one time. This means that for a unit of 100 men, five pipe urinals (paragraph b below) are needed. When trough urinals (paragraph c below) are used, 10 feet of length should be allowed for every 100 men.

a. **Urinal Drainage.** Urinals should be drained either into a soakage pit or into a standard deep pit latrine if the urinals are constructed in conjunction with the pit latrine. The urine may be drained into a deep pit latrine through a pipe, a hose, or a screened trough. If a soakage pit is to be used, it should be dug four feet square and four feet deep and filled with rocks, bricks, broken bottles, or similar rubble. It should then be covered with tarpaper, boards, or other suitable material and a layer of earth. If the urine disposal facility is located some distance from the sleeping area, another urinal should be provided at a convenient location for use at night.

b. **Pipe Urinal.** Pipe urinals are the preferred type of urinal. They should be at least one inch in diameter. They are placed at each corner of the soakage pit and, if needed, on two sides halfway between the corners (figure 4-10). These pipes should extend at least eight inches below the surface of the pit. A screened funnel of tarpaper, sheet metal, or similar material is placed in the top of each pipe, the upper rim extending about 30 inches above the ground surface.

c. **Trough Urinal.** If the necessary materials are available and pipe urinals are not desired, a 10-foot long trough urinal (figure 4-11) may be built. This trough may be either U- or V-shaped and made of sheet metal or of wood. If made of wood, the trough should be lined with metal or heavy tarpaper. A splashboard is inserted down the middle of the trough. The legs that support the trough are cut slightly shorter on the one end. At the lower end, a shallow trough or a pipe is attached to carry the urine from the urinal trough to the soakage pit or deep pit latrine.

d. **Operation.** In order to ensure the proper operation of the latrine facilities, the following procedures should be observed.

- (1) Use the pipes or the trough--do not urinate on the surface of the pit.
- (2) Wash funnels or trough daily with soap and water.

(3) Replace funnels when necessary.

(4) Do not let oil or grease get into the soakage pit. Petroleum products may cause the pit to become clogged. If the soakage pit becomes clogged, a new pit must be dug.

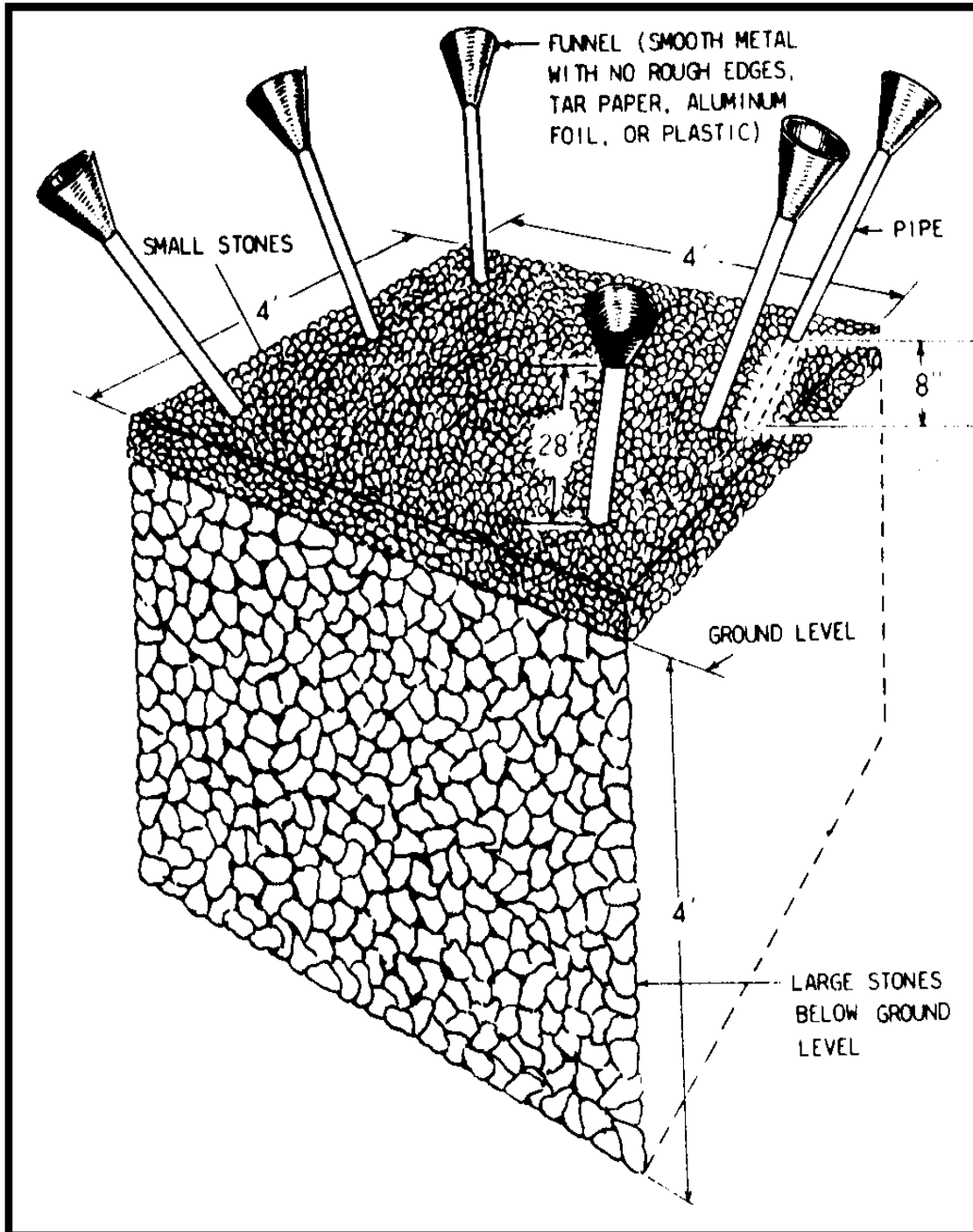


Figure 4-10. Pipe urinal.

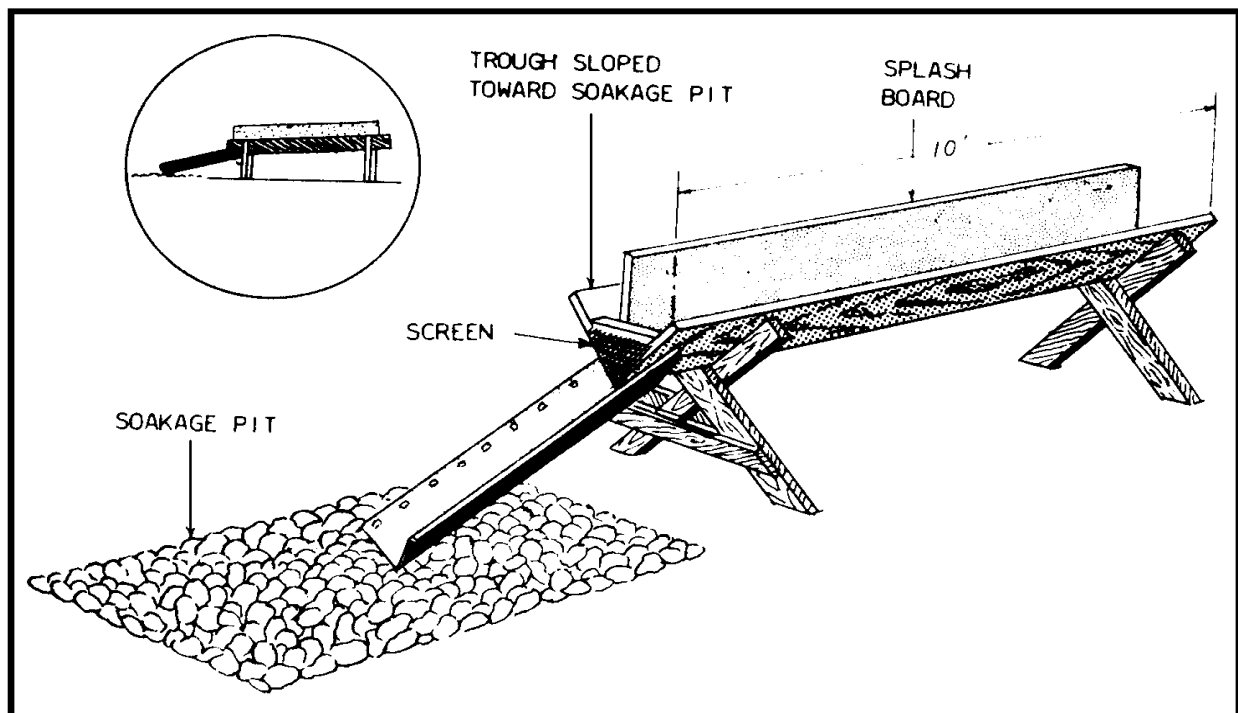


Figure 4-11. Trough urinal.

(5) It is a good practice to construct urinal facilities throughout the unit area. If, however, the urinal facilities are located some distance from the sleeping area, a large can or pail may be placed at a convenient location in the area for use as a urinal at night. The can used for this purpose must be emptied into the soakage pit or pit latrine every morning and washed with soap and water before being reused.

(6) When a urine soaked pit is to be abandoned or has become clogged, it should be sprayed with residual insecticide and mounded over with a one-foot covering of compacted earth. The site should then be marked with a sign as indicated in paragraph 4-9, if the tactical situation permits.

#### Section IV. LIQUID WASTES

##### 4-17. KITCHEN WASTES DISPOSAL FACILITIES

Liquid wastes from food service operations contain particles of food, grease, and soap. This liquid requires some kind of treatment before it is allowed to drain into a sewer or is disposed of by other means. (Grease and oil can cause the soil to lose some of its ability to absorb liquids--that is, to "clog up.") In permanent or semipermanent camps, liquid waste is passed through a grease trap before it enters the sewage system. In temporary camps, grease traps are used to take the grease from the liquid before the liquid then enters a soakage pit or a soakage trench.

a. **Soakage Pits.** In temporary camps, a soakage pit will normally dispose of liquid kitchen wastes for a total of 200 men. The only difference in the construction of a urine soakage pit and a kitchen waste soakage pit is that in the kitchen waste soakage pit, a grease trap is substituted for the pipes or troughs used in the urine soakage pit. If the camp is to last for two weeks, two kitchen waste soakage pits should be constructed, each pit to be used only on alternate days since a rest period will help to prevent clogging. A soakage pit that has become clogged should be closed and a new one constructed. When closed, the pit should be covered with one foot of compacted earth. The covered site is marked as indicated in paragraph 4-9 if the tactical situation permits.

b. **Soakage Trenches.** If the ground water level or a rock formation exists close to the surface, a soakage trench may be used instead of soakage pits. The soakage trench consists of a pit that is two feet square and one foot deep and trenches radiating outward from its sides for a distance of six feet or more (figure 4-12). These trenches are one foot wide and vary in depth from one foot at the central pit to one and one-half feet at the outer ends. The pit and trenches are filled with material similar to that used in the soakage pit. Two such units should be built for every 200 persons fed. Soakage trenches should be used on alternate days (the first soakage trench used on Monday, the second on Tuesday, the first again on Wednesday, and so forth.). A grease trap should also be used with a soakage trench.

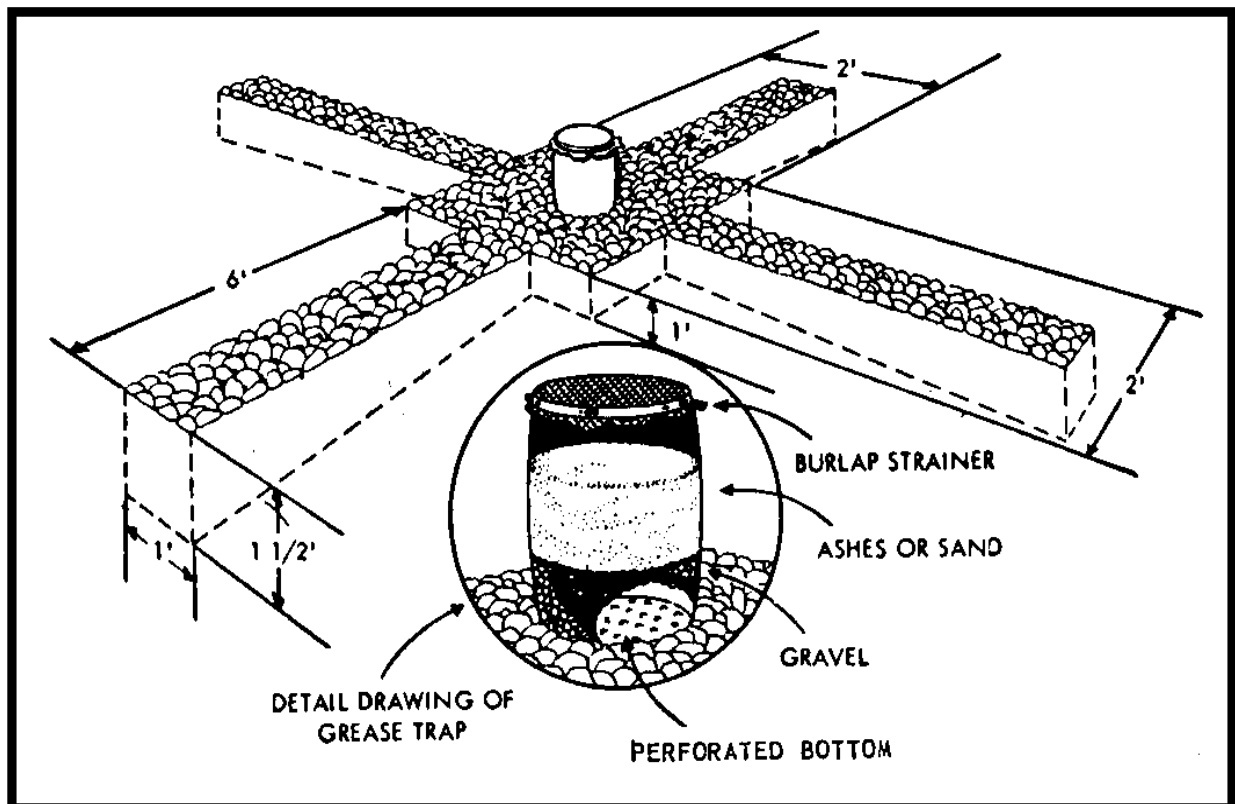


Figure 4-12. Soakage trench with barrel filter grease trap.

#### 4-18. BAFFLE GREASE TRAPS

a. **Constructing the Trap.** A baffle grease trap may be made from half of a barrel that has been cut in two (figure 4-13) or from a box (figure 4-14). The barrel or box is divided vertically into unequal chambers by a solid wooden baffle. The baffle extends from the top of the trap to within one inch of the bottom. The larger chamber should contain about two-thirds of the capacity of the box or barrel. This larger chamber should have a removable lid and a removable strainer. The strainer may be a box with holes in the bottom that is filled with straw or burlap. The strainer removes coarser solids. A one-inch pipe, inserted about three to six inches below the top of the smaller (exit) chamber, acts as an outlet to carry the liquid from the trap to the soakage pit.

b. **Operation.** Fill the chambers with cool water. Pour the wastes through the strainer to remove coarse solids. As the warm liquid strikes the cool water, the grease rises to the surface of the entrance (large) chamber and the liquids runs under the baffle to the exit (small) chamber. The outlet pipe carries the liquid from the trap to the soakage pit or soakage trench. To ensure proper operation of the trap, it must be cleaned frequently. Grease must be removed, the trap drained, the strainer cleaned, and the sediment in the bottom removed. The removable strainer may be cleaned by scrubbing the box with soap and water and filling it with new straw or burlap. The grease, sediment, and straining material should be either burned or buried.

c. **Size.** The grease trap should be of sufficient capacity so that the hot, greasy water being added will not heat the cool water already present in the trap to the point where the grease will remain uncongealed and will pass through the trap.

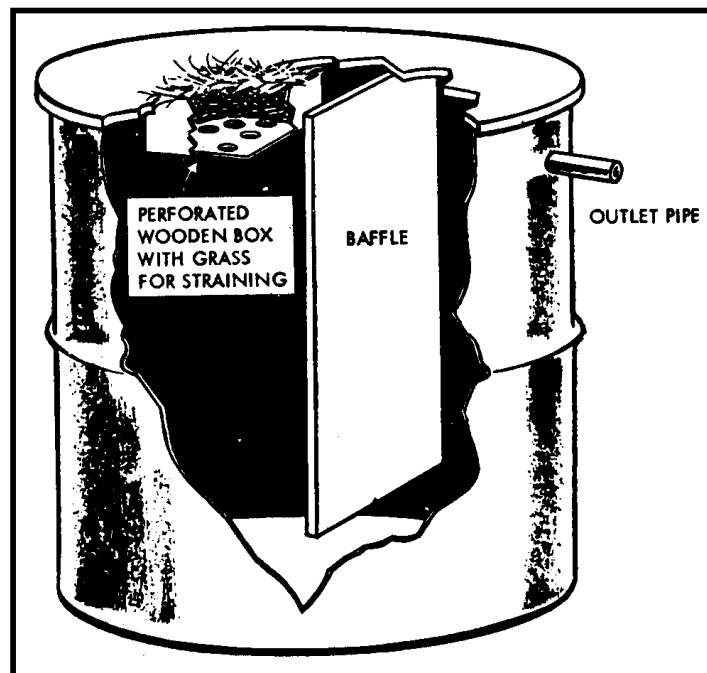


Figure 4-13. Barrel-type baffle grease trap (cut-away view).



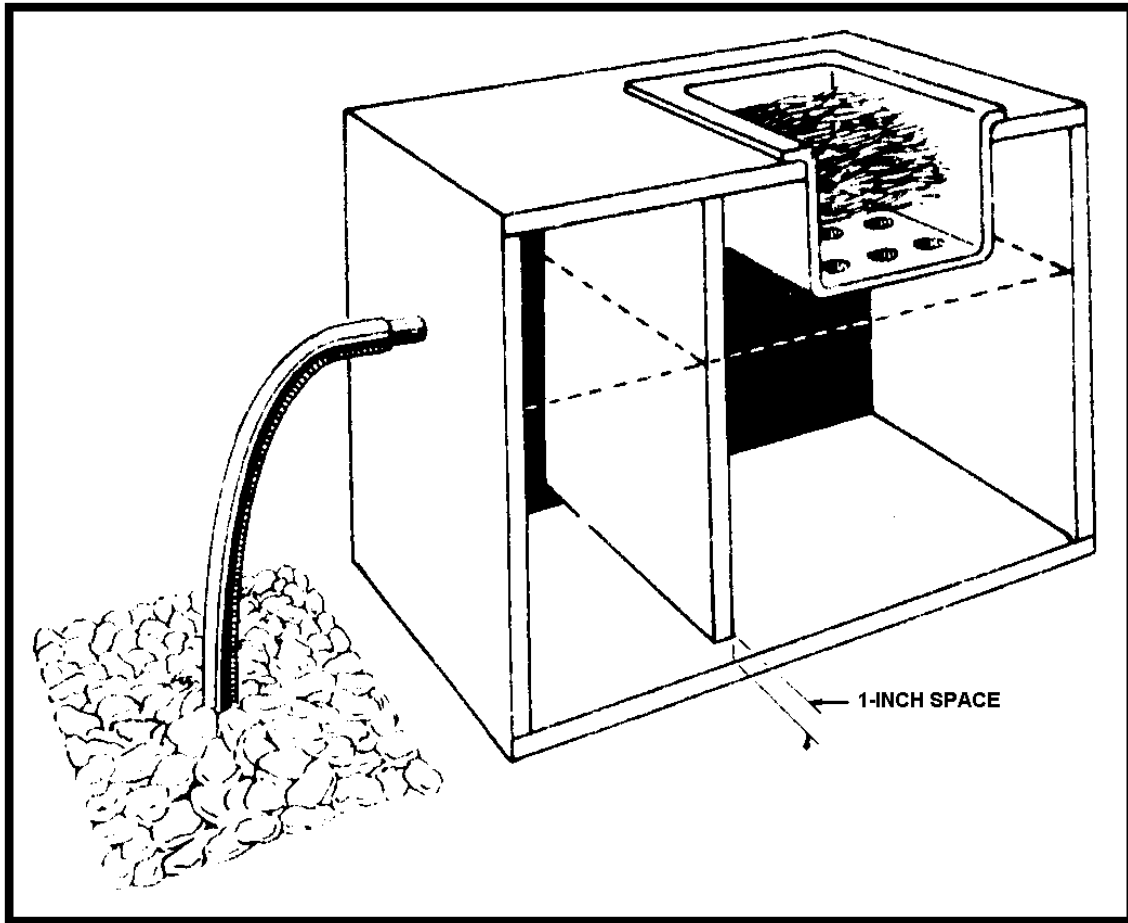


Figure 4-14. Box-type baffle grease trap (cut-away view).

#### 4-19. BARREL FILTER GREASE TRAP

The barrel filter grease trap may be made from a 30- to 50-gallon barrel or drum which has had its top removed and a number of large holes bored into the bottom (figure 4-15). Eight inches of gravel or small stones are placed in the bottom and covered with 12 to 18 inches of wood ashes or sand. A piece of burlap is fastened to the top of the barrel to serve as a coarse strainer. The trap may be placed directly over the soakage pit or it may be placed on a platform with a trough leading to the pit. The grease trap should be emptied, washed, and refilled with fresh ashes or sand every other day. The old ashes or sand should be buried. The burlap strainer should be either washed or changed every day. If burlap is not available, a pail strainer may be made by boring holes in the bottom of an old metal pail or can and filling it with grass or straw. Place the strainer on top of the wood ashes or sand in the barrel grease trap. Either the burlap strainer or the pail strainer will prevent the trap from becoming clogged by coarse food particles.

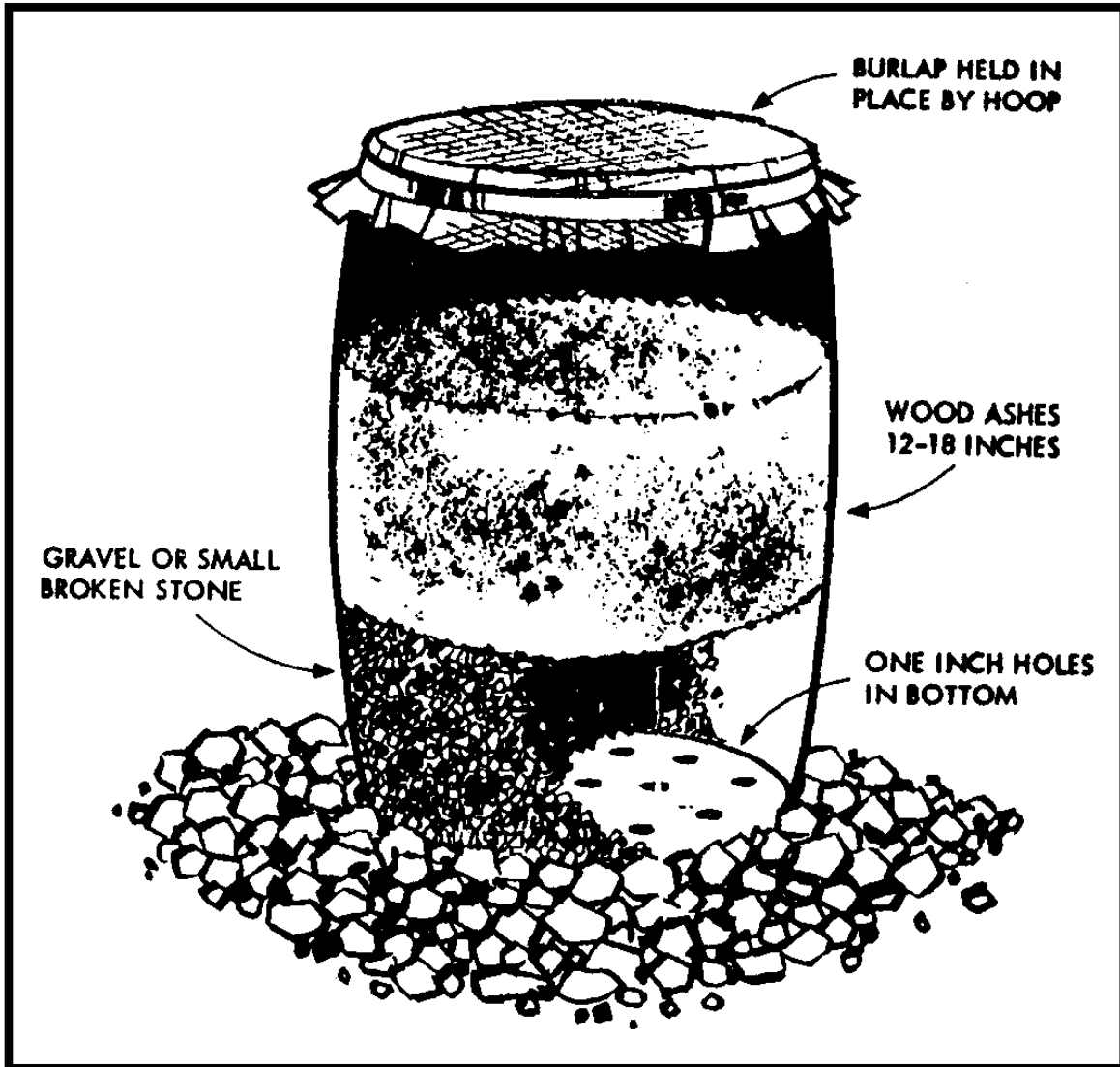


Figure 4-15. Barrel filter grease trap.

#### 4-20. EVAPORATION BEDS

In places where clay soil prevents the use of standard soakage pits, evaporation beds (figure 4-16) may be used if the climate is hot and dry.

a. **Construction.** Enough beds measuring eight feet by ten feet are constructed to allow three square feet of surface area per person per day for kitchen waste and two square feet per person per day for wash and bath wastes. The beds are spaced so that the wastes can be distributed to any one of the beds. A bed is constructed as follows.

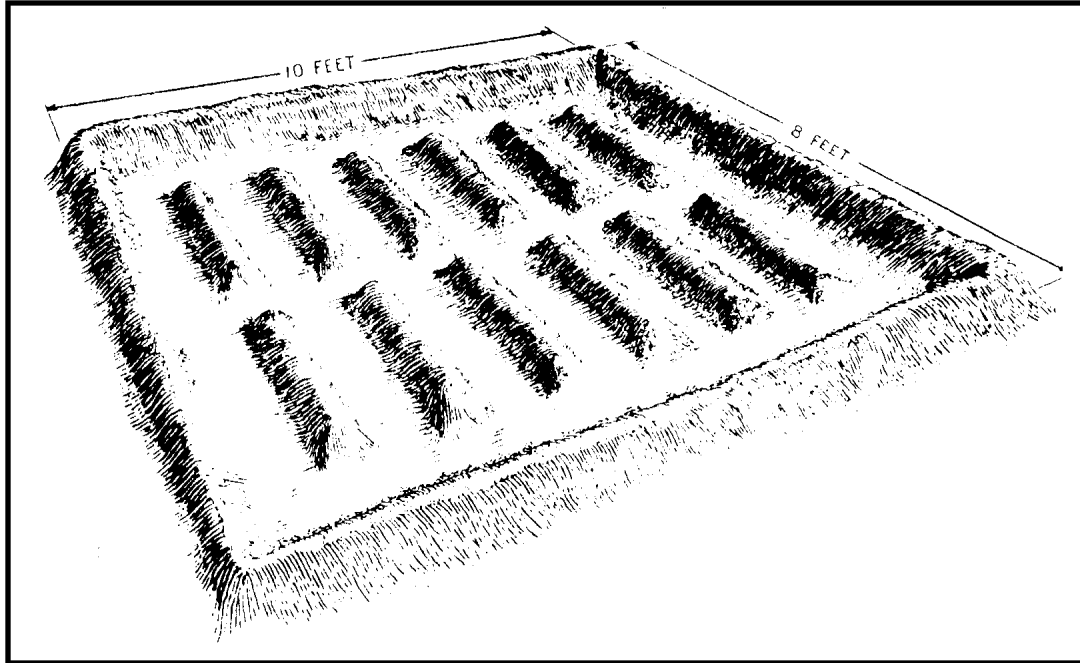


Figure 4-16. Evaporation bed.

- (1) Scrap the topsoil to the edges and form a small dike around the bed.
- (2) Spade the earth within the bed to a depth of 10 to 15 inches.
- (3) Rake the dirt into a series of rows forming ridges approximately six inches above the depressions. These rows may be formed either lengthwise or crosswise.

b. **Operation.** One bed is flooded during the day with liquid waste to the top of the ridges. The liquid waste is then allowed to evaporate and seep into the soil. After about three to four days, this bed is usually sufficiently dry for respading and reforming. The other beds are flooded on successive days and the same sequence of events is followed. Careful attention must be given to proper rotation, maintenance, and usage of evaporation beds. It is also essential that the kitchen waste be run through an efficient grease trap before it is allowed to enter the evaporation beds. If these beds are used properly, they create no insect hazard and only a slight odor.

#### 4-21. BATH AND WASH WATER

Bath and wash water are disposed of in the same manner as the liquid kitchen wastes. They should pass through a grease trap that will remove the soap before they enter the soakage pit or the soakage trench. In the field, every device that is used for washing or drinking should have some type of soakage pit or trench under it. Because of the large volume of water generated, the area under field showers should be evacuated to a depth of around four feet and filled in the same manner as a soakage pit (paragraph 4-4). The top of the pit should be covered with small, smooth stones.

## Section V. GARBAGE, RUBBISH, AND INFECTIOUS WASTES

### 4-22. GARBAGE DISPOSAL

Garbage is the solid or semisolid waste resulting from the preparation, cooking, and serving of food. It does not include rubbish. Garbage is disposed of by burial or incineration.

a. **Burial.** On the march, in bivouac, or in camps, of less than one week's duration, garbage is buried in pits or trenches. These pits or trenches should not be over 30 yards from the dining area and must not be closer than 100 feet to any source of water used for drinking or cooking.

(1) Pit. A pit four feet square and four feet deep is suitable for one day for a unit of 100 men. At the end of the day or when the pit is filled to within about one foot of the surface, the pit is sprayed with insecticide, filled in with earth, and mounded over with an additional foot of compacted earth.

(2) Trench. Sometimes a continuous trench two feet wide and four feet deep may be used for the burial of garbage. The length of the trench depends upon the length of time it is to be used. The trench is extended as required. Dirt that is removed to extend the trench is used to cover the garbage that has been added during the day.

b. **Incineration.** If burial is not practicable, incinerators are constructed for use in the field. Excellent types of open incinerators may be constructed from materials that are readily available in any camp area. Since incinerators will not handle wet garbage, it is necessary to separate the liquid from the solid portion. This is done by straining the garbage with a coarse strainer such as an old bucket, salvaged can, or a 55-gallon drum in which holes have been punched in the bottom. The solids remaining in the strainer are incinerated and the liquids are poured through a grease trap into a soakage pit or trench. Field incinerators should be located at least 50 yards downwind from the camp to prevent their odor from being a nuisance.

(1) Inclined plane incinerator. The inclined plane incinerator (figure 4-17) will dispose of garbage of an entire battalion, evacuation hospital, or other unit of similar size. Its effectiveness in combustion and the fact that it is somewhat protected from rain and wind make it an excellent improvised device. Time and skill, however, are required in building it. A sheet metal plane is inserted through telescoped 55-gallon drums from which the ends have been removed. The metal plane should extend approximately two feet beyond the upper end of the telescoped drums to serve as a loading or stoking platform. The telescoped drums are positioned on an inclined surface. A grate is placed at the lower end of the telescoped drums to catch the garbage that is to be burned. A wood or fuel oil fire is under the grate. After the incinerator becomes hot, drained garbage is placed on the loading platform. As the garbage becomes dry, it is pushed through the telescoped drums in small amounts to burn. Final burning takes place on the grate.

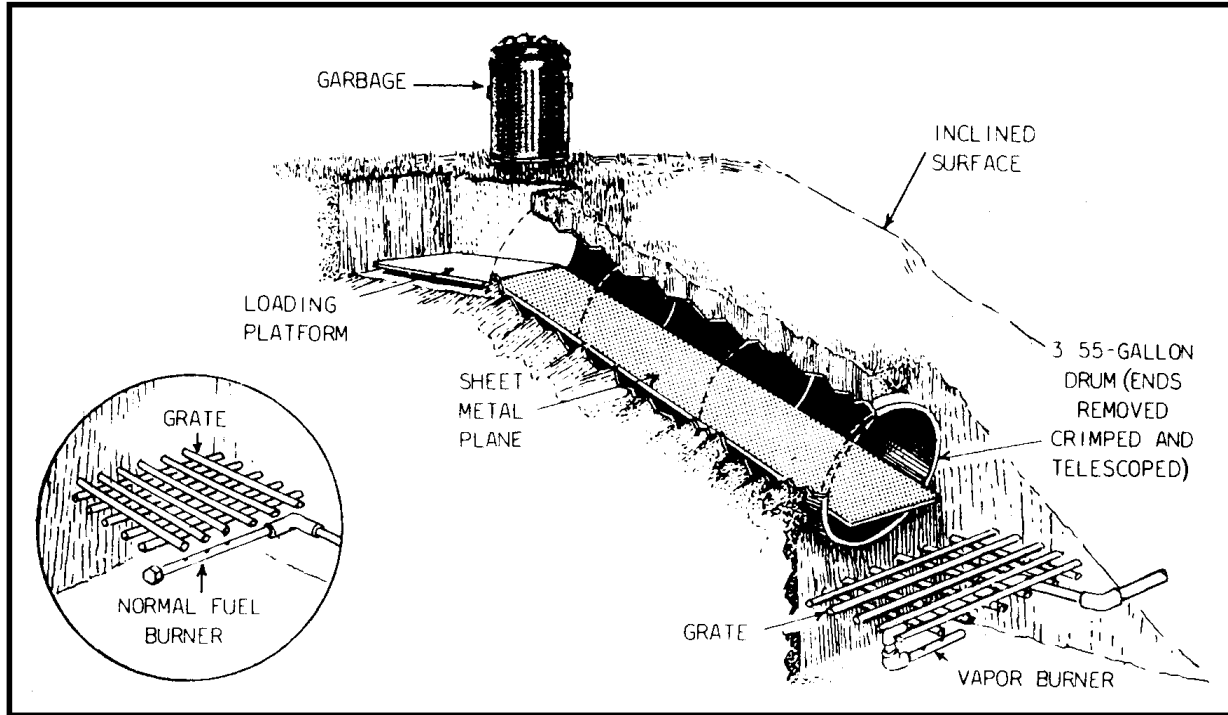


Figure 4-17. Inclined plane incinerator.

(2) Simplified inclined plane incinerator. If time does not permit the construction of the inclined plane incinerator as illustrated in figure 4-17, a simplified version can be constructed. Dig a fire pit at the bottom of an incline, line it with rocks, and place a grate over it. Place three telescoped drums in a shallow trench up the incline. Let the lower end of the telescoped drums extend somewhat over the fire pit so the flame will be drawn up into the drums. If a sheet metal plane is available, it should be inserted inside the drums since it helps the garbage to dry more thoroughly before being burned.

(3) Barrel incinerator. A barrel incinerator (figure 4-18) is made from a 55-gallon drum by cutting out both ends, punching many holes in the side near the bottom of the drum, and inserting grates inside the barrel several inches above the holes. The barrel is placed on stones, bricks, or dirt-filled cans so that the bottom of the barrel is several inches above the ground and air can get to the bottom of the barrel easily. A fire is then built in the space under the garbage barrel. Garbage is put onto the top grate of the barrel and incinerated by the heat from the fire.

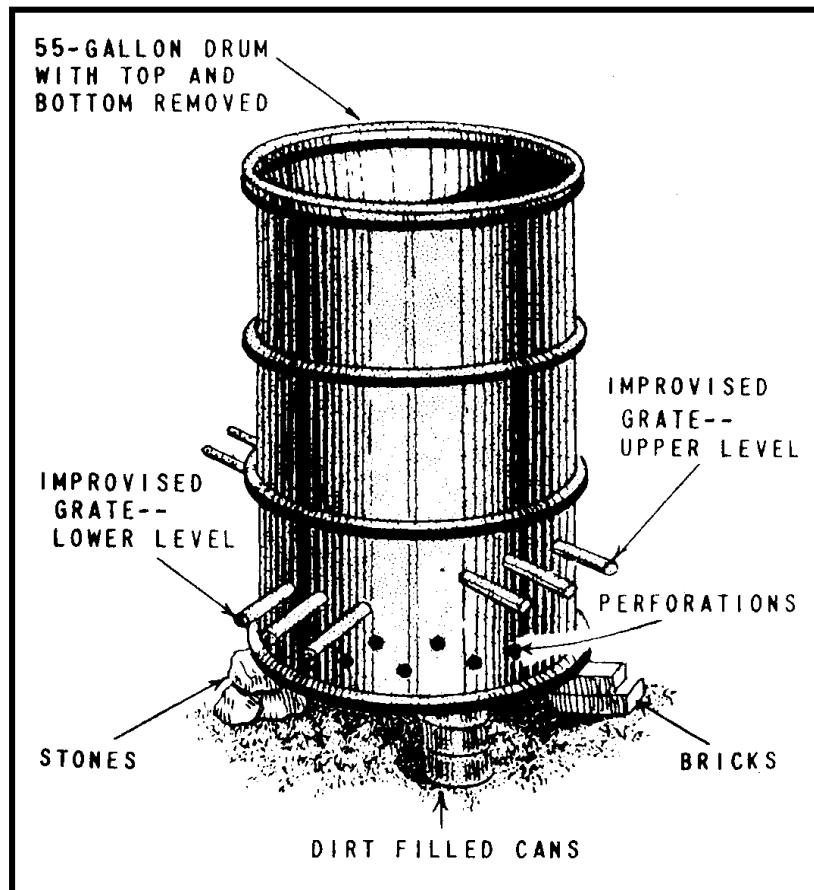


Figure 4-18. Barrel incinerator.

#### 4-23. RUBBISH DISPOSAL

Rubbish or trash consists of wastes that originate at kitchens, barracks, wards, quarters, and offices. It includes such items as emptied containers, waste paper, wood, metal, glass, ashes, and crockery. Depending on the local salvage program, some of these items may be salvaged and reused or sold. Rubbish can be divided into two classes--combustible (that which can be burned) and noncombustible (that which will not burn).

a. **Bivouac.** On bivouac and at temporary camps, rubbish is usually buried in pits or in trenches with the garbage. If this is done, care should be taken to flatten tin cans and break down boxes before they are added to the pit or trench. If cans are not flattened and boxes are not broken, they use too much of the space in pits or trenches.

b. **Camps.** In camps where the length of stay is over one week, the combustible rubbish is usually burned in a barrel incinerator (figure 4-18) and the noncombustible rubbish is either buried or hauled to a suitable site.

#### 4-24. INFECTIOUS WASTE DISPOSAL

Infectious wastes are those wastes that are contaminated with disease organisms and/or which are offensive from the standpoint of sight or odor. Examples of infectious wastes are bandages, animal carcasses, laboratory tissue specimens, dressings, surgical wastes, food service wastes from infectious disease wards, used disposable needles and syringes, and materials contaminated with blood, body fluids, or excreta.

a. **Collection.** The proper collection and handling of infectious wastes is extremely important. Hospital, laboratory, and other medical facility commanders are responsible for this function. Only trained Army Medical Department personnel should be detailed to carry it out. Personnel handling infectious wastes must wear protective clothing (gloves, apron, goggles, and so forth). Only containers specifically designated and marked for that purpose should be used for the collection of infectious waste. The normal marking is a yellow band around the container. A plastic bag or liner should be used to minimize the contamination of the container itself. Infectious waste should be disposed of more frequently than other types of waste--at least daily.

b. **Disposal.** The preferred method for disposing of infectious wastes is by burning in incinerators specifically designed for these wastes. If appropriate incinerators are not available, infectious waste may be buried with the specific approval of the appropriate medical officer.

**Continue with Exercises**

## EXERCISES, LESSON 4

**INSTRUCTIONS:** The following exercises are to be answered by circling the letter of the response that best answers the question or best completes the incomplete statement.

After you have completed all of the lesson exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Which of the following is preferred in the collection and disposal of human waste?
  - a. Portable toilets.
  - b. Straddle trench latrines.
  - c. Bored-hole latrines.
  - d. Mound latrines.
  
2. An all-male unit of 200 persons should provide enough latrines so that \_\_\_\_ men can be using the latrines at the same time.
  - a. 4.
  - b. 8.
  - c. 16.
  - d. 24.
  
3. Using the same situation given in exercise 2 above, how many urinal pipes would be needed to support the unit?
  - a. 6.
  - b. 10.
  - c. 18.
  - d. 24.



4. Deep pit latrines should usually not be dug to a depth in excess of \_\_\_\_\_ feet.
- a. Two and one-half.
  - b. Three.
  - c. Four.
  - d. Six.
  - e. Eight.
5. Bored-hole latrines are normally \_\_\_\_\_ feet deep.
- a. Two and one-half.
  - b. Four to six.
  - c. Eight to twelve.
  - d. Fifteen to twenty.
6. On the march, an individual disposes of his own excreta by means of a:
- a. Cat hole.
  - b. Foxhole.
  - c. Deep pit latrine.
  - d. Straddle trench.

7. Soiled dressings and bandages are classified as:
- a. Garbage.
  - b. Human waste.
  - c. Infectious waste.
  - d. Liquid waste.
  - e. Rubbish.
8. A field showering facility has been constructed using 55-gallon drums. The water to be used for showering is too cool. One way of making the water warmer would be to paint the drums using \_\_\_\_\_ paint.
- a. Bright red.
  - b. Black.
  - c. White.
  - d. Yellow.
9. In camps of less than one week's duration, garbage and rubbish are usually:
- a. Burned.
  - b. Buried.
  - c. Dumped in a lake or river.
  - d. Placed in barrels and transported with the unit until an approved disposal site is reached.

10. Your unit contains 350 males. How many straddle trench latrines, each two feet long, will be required to accommodate the males?
- a. 14.
  - b. 21.
  - c. 28.
  - d. 56.
11. In a baffle grease trap, the barrel or box is divided into unequal chambers by a vertical wooden baffle. Which one of the following statements is true concerning the baffle?
- a. The baffle is solid and it rests on the bottom of the barrel or box.
  - b. The baffle is solid and there is about a one inch space between the bottom of the baffle and the bottom of the barrel or box.
  - c. The baffle is solid and there is about a six-inch space between the bottom of the baffle and the bottom of the barrel or box.
  - d. The baffle has holes about one-half inch in diameter and it rests on the bottom of the barrel or box.
12. Urinal soakage pits usually measure:
- a. Two feet wide, six feet long, and 2-1/2 feet deep.
  - b. Four feet wide, four feet long, and four feet deep.
  - c. Four feet wide, eight feet long, and six feet deep.
  - d. Eight feet wide, eight feet long, and six feet deep.

13. After burning the contents of a burn-out latrine, a dry, odorless ash remains. What should be done now?
- a. Add fuel to the drum and burn the contents again.
  - b. Mix the ash with water and pour the mixture through a grease trap.
  - c. Bury the ash.
  - d. Pour the ash into a lake, river, or swift running stream.
14. Which one of the following statements is true concerning the construction of a mound latrine?
- a. The pit is marked off and the mound is built around it.
  - b. The bottom of the pit should be even with the water level of the area.
  - c. The ground where the mound is to be built should be broken up before the mound is built.
  - d. The slope of the mound should be as steep as possible.
15. You are digging deep pit latrines to be used with a standard two-seat latrine box. What should be the length and width of the pit at the top?
- a. One foot wide and two feet long.
  - b. Two feet wide and 3-1/2 feet long.
  - c. Two feet wide and eight feet long.
  - d. Two and one-half feet wide and eight feet long.

**Check Your Answers on Next Page**

## SOLUTIONS TO EXERCISES, LESSON 4

1. a (para 4-2b)
2. b (para 4-8b) ( $200 \times 4 \text{ percent} = 200 \times .04 = 8$ )
3. b (paras 4-8b, 4-16) ( $200 \times 0.05 = 10$ )
4. d (para 4-11b)
5. d (para 4-13)
6. a (para 4-7a)
7. c (paras 4-1d, 4-24)
8. b (para 4-6)
9. b (paras 4-22a, 4-23a)
10. a (para 4-10) ( $350 \times 0.04 = 14$ )
11. b (para 4-18a; figure 4-14)
12. b (para 4-4; figure 4-10)
13. c (para 4-15b)
14. c (para 4-12a)
15. b (para 4-11b)

**End of Lesson 4**

## LESSON ASSIGNMENT

### SUBCOURSE MD0535

Communicable Diseases and Field Sanitation.

### LESSON 5

Control of Arthropod-Borne and Rodent-Borne Diseases.

### LESSON ASSIGNMENT

Paragraphs 5-1 through 5-25.

### LESSON OBJECTIVES

After completing this lesson, you should be able to:

- 5-1. Identify ways in which arthropods affect the health of man.
- 5-2. Distinguish between different types of arthropods.
- 5-3. Identify unit control measures used against mosquitoes, ticks, mites, lice, fleas, and flies.
- 5-4. Select sanitation controls necessary for a healthy field environment.
- 5-5. Identify common signs of a rodent infestation.
- 5-6. Identify the five steps in a rodent control program and their normal sequence.

### SUGGESTIONS

After studying the assignment, complete the exercises of this lesson. These exercises will help you to achieve the lesson objectives.

## LESSON 5

### CONTROL OF ARTHROPOD-BORNE AND RODENT-BORNE DISEASES

#### Section I. MOSQUITO-BORNE DISEASES

##### 5-1. MOSQUITOES

Mosquitoes are found all over the world. They are responsible for more diseases in man than any other arthropod. In tropical and subtropical areas, they breed throughout the year. They appear in tremendous numbers even in the subarctic regions during the brief summer season. Most of the disease-carrying mosquitoes are found in the milder climates and in the Tropics. Different types of mosquitoes transmit different types of diseases. The three most common genera of mosquitoes that transmit diseases are *Anopheles*, *Aedes*, and *Culex*. Each genus consists of many species.

a. **Life Cycle.** Mosquitoes go through four stages during their life cycle--egg, larva, pupa, and adult (figure 5-1). The time required for mosquitoes to complete their life cycle varies greatly depending upon their species and the weather conditions. Most species of medical importance require approximately one to three weeks to complete the cycle from the egg to the adult. Adult mosquitoes may live from two weeks to several months, depending upon their species. The larval and pupal stages of all mosquitoes are passed in water where the larvae, sometimes called wigglers, can be easily detected and destroyed. Adult male mosquitoes do not suck blood. It is the adult females who are bloodsuckers and who transmit disease. A person may not be aware that a mosquito has "bitten" him (penetrated his skin with its needle-like proboscis) until later when the site of the bite (puncture) begins to itch.

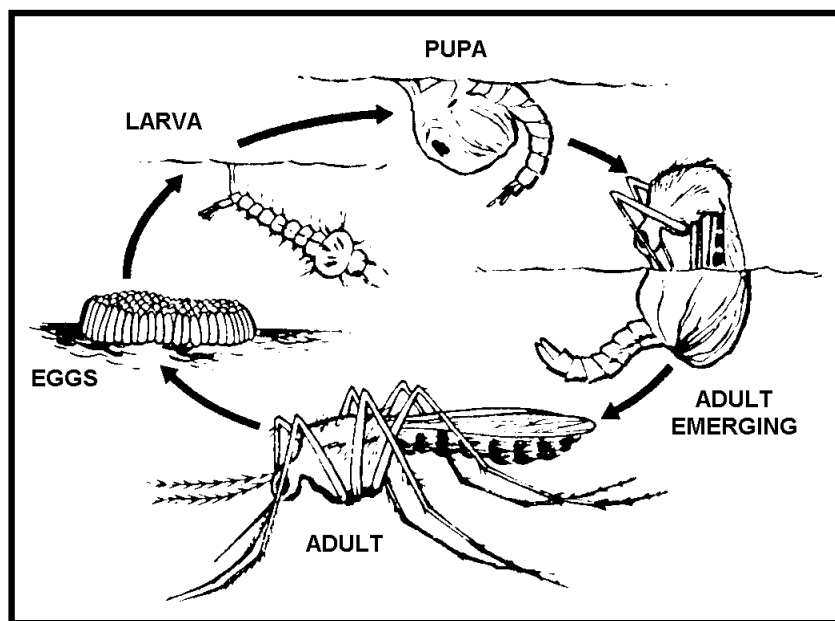


Figure 5-1. Life cycle of the mosquito.

b. **Breeding Areas.** Mosquitoes will breed in practically any collection of water that stands longer than five to seven days. Different kinds of mosquitoes vary in their choice of breeding places. Some like sunlit places whereas others prefer the shade. Some prefer fresh water to stagnant water. Others prefer the brackish water of salt marshes. Common breeding sites are ponds, pools, slow-moving streams, inland swamps and bogs, salt marshes, ditches, tree holes, rock holes, and manmade containers of water. Manmade containers include wells, cisterns, rain barrels, roof gutters, road gutters, cans, buckets, drains, cesspools, septic tanks, pit latrines, excavation sites, road holes, bomb craters, and old tires that have been discarded.

c. **Characteristics of Anopheles, Aedes, and Culex Mosquitoes.**

(1) Anopheles. *Anopheles* mosquitoes bite primarily during the period from dusk to dawn. They may bite during the daylight hours in an area that is heavily shaded or in a room that is dark. Most species will breed in any collection of water, but some species breed only in tree holes. The larvae lie parallel to the surface of the water. The adults usually rest and feed with the body at an angle of 45° to the surface (figure 5-2).

(2) Aedes. *Aedes* mosquitoes bite in daylight. They breed in fresh, stagnant, or brackish water. *Aedes aegypti*, one of the most important disease transmitters, breed almost entirely on old tires, tin cans, flower vases, and other similar manmade containers. The larvae hang at an angle to the surface of the water. The adult rests and feeds with its body parallel to the surface (figure 5-2).

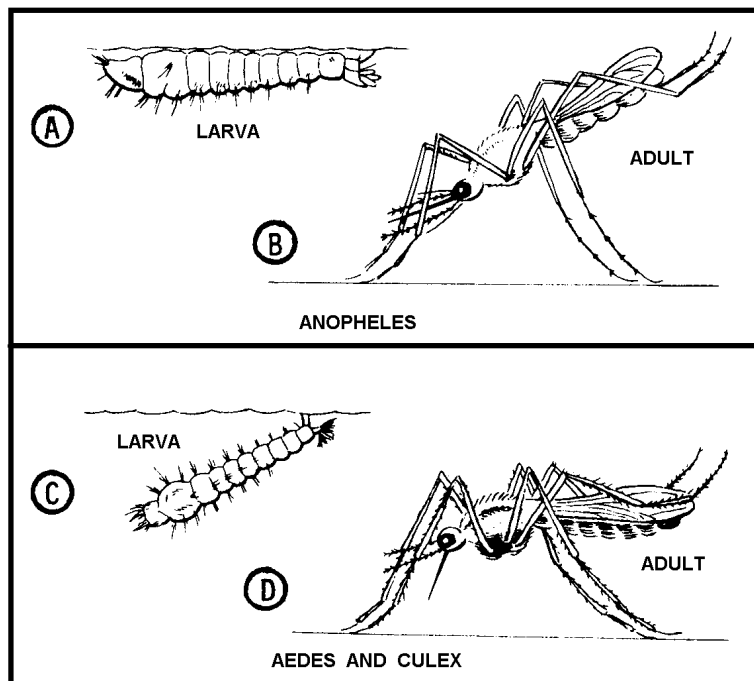


Figure 5-2. Typical positions of mosquitoes. A *Anopheles* larva. B *Anopheles* adult. C *Aedes* or *Culex* larva. D *Aedes* or *Culex* adult.



(3) Culex. *Culex* mosquitoes, depending upon the species, may bite any time of the day or night. They are commonly found in fresh or stagnant water in and about buildings and in swamps, ditches, street gutters, cesspools, and other places which hold water. The common house mosquitoes found in the US are members of this group. The larvae hang at an angle in the water and the adults rest and feed parallel to the surface as do *Aedes* mosquitoes (figure 5-2).

## 5-2. MOSQUITO-BORNE DISEASES

There are many diseases transmitted by mosquitoes. Some of the more important ones are malaria, yellow fever, dengue fever, encephalitis, and filariasis. Antimosquito measures are the major weapons against this group of diseases. Drugs are available for the suppression and cure of malaria and a vaccine is available for the prevention of yellow fever.

a. **Malaria.** Of the mosquito-borne diseases, malaria is the greatest threat to military operations. Although the occurrence of malaria is rare in the US, it is common in most tropical, subtropical, and semitropical areas of the world. Malaria is caused by a microscopic parasite carried by the *Anopheles* mosquito. This parasite destroys the blood cells and causes chills, fever, weakness, and anemia. Unless the disease is treated promptly and properly, it may cause death from damage to the brain. The only sure way of preventing malaria is to avoid the bites of infected mosquitoes. When complete mosquito control (paragraph 5-3) is difficult or even impossible (such as during periods of active combat), the prevention of malaria is dependent upon the application of individual protective measures against the bites of mosquitoes (paragraph 1-28) and the use of antimalarial drugs. These drugs are referred to as suppressive drugs in that they do not actually prevent infection by the disease organisms. Rather, they destroy the parasites within the infected person's body and thus suppress the symptoms.

b. **Yellow Fever.** Yellow fever is a viral disease now confined to tropical Africa and tropical America. The virus is primarily transmitted by *Aedes aegypti* mosquito. Yellow fever is characterized by fever, headache, backache, jaundice, and internal bleeding. The most important preventive measures include the administration of a highly effective vaccine and the application of individual protective measures against the bites of mosquitoes.

c. **Dengue Fever.** The term "dengue" refers to a group of viral diseases that are widespread throughout the tropical areas of the world. These diseases are transmitted by *Aedes* mosquitoes. Often the only symptom is a mild fever, but there may also be severe muscular pain. No vaccine is available for these diseases. The best means for avoiding dengue fever is the prevention of mosquito bites by using individual protective measures.

d. **Encephalitis (Sleeping Sickness).** There are many forms of encephalitis throughout the world. They are viral diseases that usually affect the central nervous

system (brain and spinal cord). The viruses are transmitted by *Aedes* and *Culex* mosquitoes. No vaccines are available; thus, individual protective measures are essential in the prevention of this group of diseases.

e. **Filariasis (Elephantiasis).** This disease mainly occurs in Africa, the Pacific, and Far East areas. It is caused by a tiny worm (nematode) that is injected into the body by the bite of an infected *Aedes*, *Culex*, or *Anopheles* mosquito. If only a few of these parasites are in the body, they will do no harm and will eventually die. Natives who develop ugly swollen limbs from this disease have been reinfected with the parasite continually over a period of many years. Avoiding mosquito bites is the best preventive measure.

### 5-3. UNIT MOSQUITO CONTROL MEASURES

a. **Selection of Bivouac Site.** A bivouac site is selected according to well-defined military and sanitary rules. The ideal location of a bivouac site is on high, well-drained ground at least one mile from breeding sites of mosquitoes and flies and one mile from the habitation of natives who may serve as reservoirs of mosquito-borne diseases. It is not always possible, however, to bivouac in the ideal location. A unit commander may be confronted, therefore, with the necessity for mosquito control near his camp site. The area for which the unit is responsible for mosquito control generally includes the camp site and 100 yards beyond the perimeter of this site. If only minor mosquito-breeding sites exist, the area may be extended farther.

b. **Control of Breeding Sites.** Since all mosquitoes require water for breeding, the control of water sites is the most effective means of eliminating mosquitoes. This can be accomplished by ensuring the proper disposal of discarded containers; by eliminating any holes, ruts, or other low areas in which water can collect and stand; and by applying an insecticide to breeding areas that cannot be eliminated at sufficient intervals to kill the mosquito larvae. Only a small quantity of insecticide is necessary to obtain control. Any large bodies of standing water in which mosquitoes are breeding should be reported so that control measures such as ditching, draining, and filling may be accomplished by units with the required capabilities.

c. **Control of Adult Mosquitoes.** Adult mosquitoes, as well as other insects, are controlled by clearing away such mosquito resting places as tall grass, bushes, and vines; by space spraying with an insecticide; and by applying a residual insecticide to shelters, dining areas, and latrines. Adult mosquitoes are further controlled by the application of individual protective measures prescribed to protect troops against mosquito bites described in paragraph 1-28.

d. **Mosquito Proofing.** All buildings where soldiers gather should have fine mesh screening (18-mesh) on doors and windows. Screen doors should open outward and close automatically. They should be of sturdy construction where they will not warp or sag. They should be reinforced at hand and foot levels with cross-strips of wood or metal. Strips of wood or metal should also block any spaces between the frame and the

door where mosquitoes might enter. In highly malarious areas, entrances should have a vestibule with double screen doors at least six feet apart and open outwards. Cracks, knotholes, and other openings in screened buildings should be filled in. Torn screening must be repaired promptly. Occupants of each barracks building are responsible for their own minor repairs. Unit field sanitation teams should make regular inspections of the facilities and promptly report repair requirements.

## **Section II. TICK-BORNE DISEASES**

### **5-4. TICKS**

Ticks are commonly called insects. Technically, however, they are arachnids--the class of arthropods that includes spiders, mites and scorpions. Ticks occur throughout the world, but they are less common in the arctic and subarctic zones. They are divided into two groups--the hard ticks and the soft ticks. The hard tick has a hard shield on its back and its mouthparts can be seen from above (figure 5-3 A ). The soft tick does not have a hard shield on its back and its mouthparts cannot be seen from above (figure 5-3 B ). The soft tick often has a leather-like appearance.

a. **Life Cycle.** The life cycle of the tick consists of four stages--egg, larva, nymph, and adult (figure 5-4). In the larva stage, the tick only has six legs. Ticks in the larva, nymph, or adult stages will attach to humans, puncture the skin, and consume the person's blood.

b. **Characteristics.** Hard ticks and some soft ticks often climb upon grass and vegetation and then wait for a suitable host to pass by. Should a person brush by the vegetation, the tick will quickly attach itself to the person's clothing and then take a blood meal. Soft ticks that transmit relapsing fever usually remain hidden in cracks and crevices of buildings during the day and feed at night.

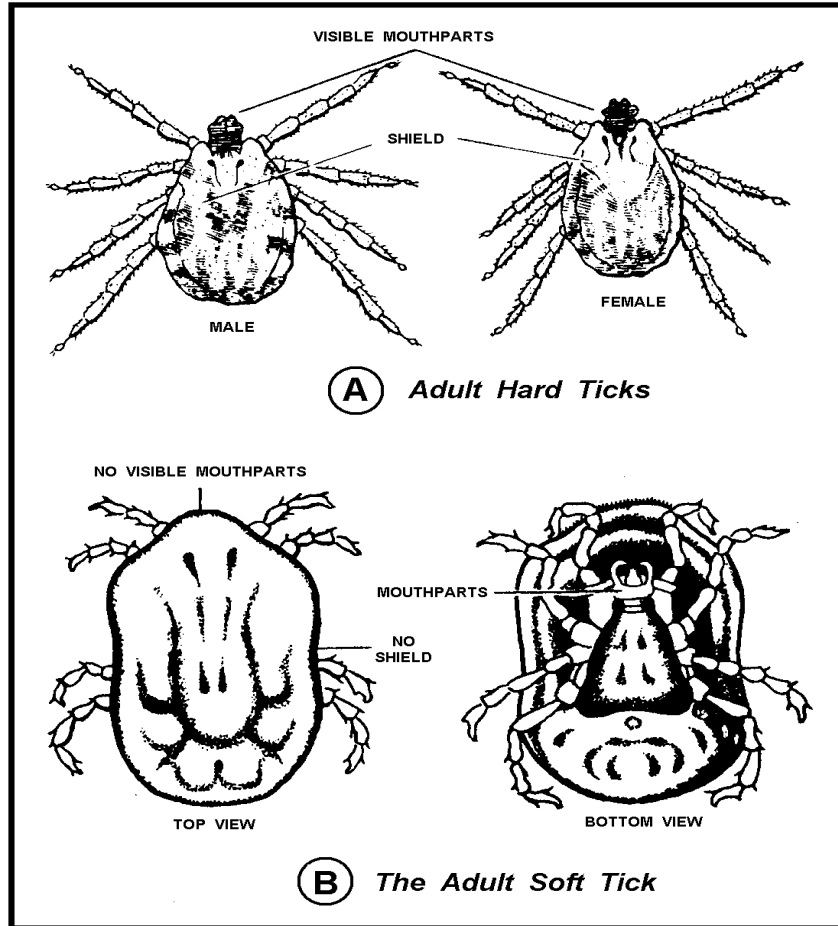


Figure 5-3. Ticks. A Adult hard tick. B Adult soft tick.

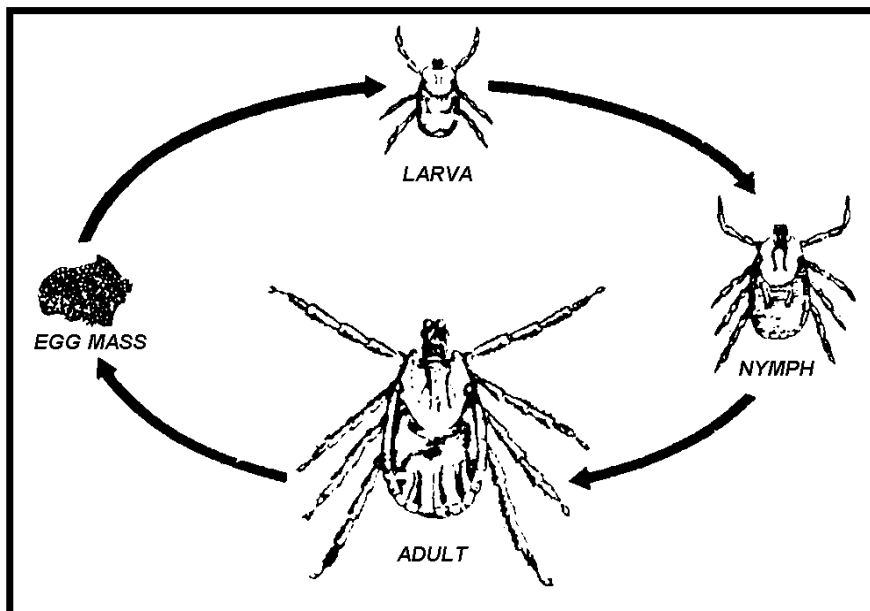


Figure 5-4. Life cycle of the hard tick (note six-legged larva).

## 5-5. TICK-BORNE DISEASES

a. **Hard Ticks.** Hard ticks are known to transmit several diseases such as Rocky Mountain spotted fever and other typhus-like fevers, tularemia (rabbit fever), Q fever, and certain viral diseases. Some types of hard ticks can cause tick paralysis. This condition results after a female hard tick has remained attached to the base of a person's neck or to the back of his head for several days. It is most likely to occur when the tick attaches near the hairlines or in the hair, thus making detection of it difficult. When tick bites are numerous, the skin may become badly inflamed and infected.

b. **Soft Ticks.** Several species of soft ticks become infected with disease organisms when they feed on infected animals. They can then transmit the disease when they bite humans to feed on their blood. Both the hard and the soft ticks can pass disease-causing organisms to their offspring through their eggs. Thus, ticks may already be infected when they hatch.

## 5-6. TICK CONTROL METHODS

a. **Environmental Control.** Controlling vast areas of tick-infested land is a major operation accomplished by either a preventive medicine unit or other trained personnel. A certain degree of control can be accomplished by clearing away brush and vegetation and keeping animals out of the area. Ticks in buildings can be controlled by spraying or dusting insecticides on walls and in cracks and corners. Insecticides may also be used to spray or dust the vegetation and the ground in tick-infested areas. Effective control of ticks is greatly dependent upon knowledge of the species present.

b. **Individual Protective Measures.** Impregnating clothing with an insecticide clothing repellent gives excellent protection against ticks. Insect repellent (DEET) applied to the exposed skin provides additional protection. The bottoms of trousers should be tucked inside the boots without blousing rubbers.

c. **Removal of Ticks.** It may require some time for ticks to infect a person after they attach to his body. Persons in tick-infested areas should examine themselves and each other at least every two hours for the presence of ticks. This will often prevent the transmission of disease. In the removal of an imbedded tick, care must be taken not to crush it or to leave its mouthparts imbedded in the skin. A tick can be removed most effectively by using small forceps to grasp it as close to its mouthparts as possible and then carefully pulling it off. The tick should not be grasped by its abdomen since the pressure may cause disease organisms to be injected into the person. After a tick is removed, it should be killed. Treat the bitten area with a suitable antiseptic.

### SECTION III. MITE-BORNE DISEASES

#### 5-7. MITES

Mites, like ticks, are arachnids. They are too small to see with the naked eye, but may be readily observed with a low-power magnifying glass. They are found throughout most of the world in practically all climates. Many mites feed on plants, but some feed on man and animals. Mites lay eggs that hatch into six-legged larval mites. Certain mites feed on man and animal only in this larval stage. The larvae are commonly called chiggers. Chiggers often occur in tall grass or in scrub vegetation. Larval mites develop into nymphs that, in turn, develop into adult mites (figure 5-5). Both the nymphs and adults have eight legs.

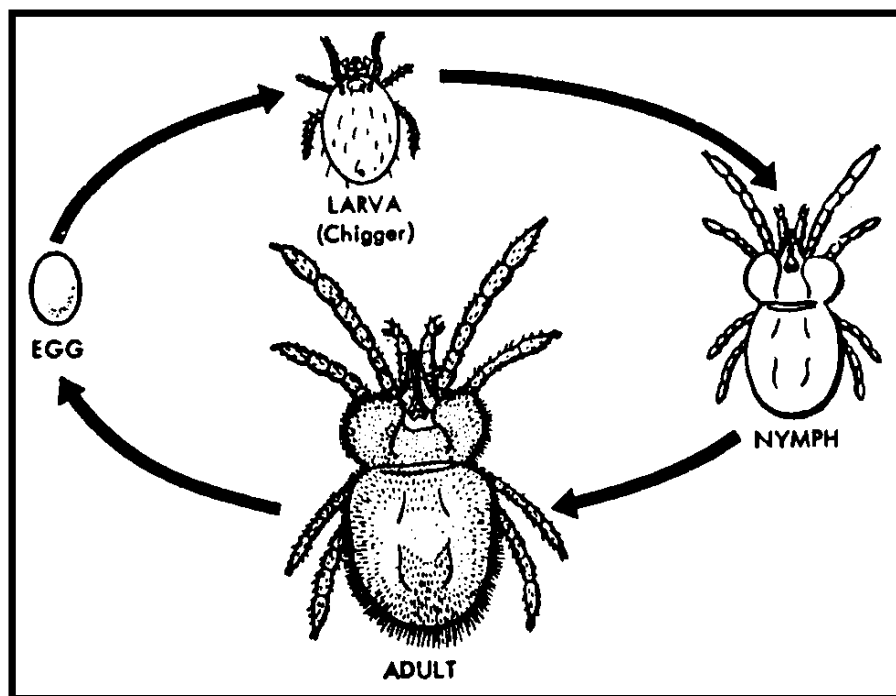


Figure 5-5. Life cycle of a mite (note six-legged larva or chigger).

#### 5-8. MITE-BORNE DISEASES

a. **Scrub Typhus.** In Southeast Asia, some kinds of chiggers transmit a dangerous disease called scrub typhus. It has a fatality rate of up to 40 percent in untreated cases. It is often accompanied by a "punched out" skin ulcer at the point of attachment of an infected mite. Other symptoms include headache, profuse sweating, a sudden fever, and a dull red eruption (rash) on the trunk. The rash usually develops about four or five days after the person becomes infected.

b. **Scabies.** The scabies itch mite (*Sarcoptes scabiei*) burrows and lives in the skin of man. It causes a condition called scabies, which is characterized by intense

itching. Scabies itch mites are killed by applying an appropriate insecticidal medication, prescribed by a medical officer, to affected parts of the skin. Washing the skin thoroughly with soap and water before applying the medication will aid in its effectiveness. This should be applied as prescribed until all the mites are killed. Clothing and bedding should be thoroughly laundered to prevent reinfection.

c. **General Infections.** Bites from chigger mites and some rodent mites may cause severe itching. Infection may result from scratching these bites.

## **5-9. MITE CONTROL METHODS**

a. **Unit Control.** Area control of larval mites (chiggers) is often difficult or impractical. In permanent or semipermanent camps located in scrub typhus areas, it is desirable to remove all surrounding growth with a bulldozer, burn the collected debris, and place tents two or three feet off the ground. Application of insecticide to the ground in the camp area and in training areas will aid in mite control. Control of rodents is also helpful in reducing the number of chiggers.

b. **Individual Control.** Mite-infested areas should be avoided if possible. If mite-infested areas cannot be avoided, the troops should apply individual protective measures as follows.

(1) All personnel operating in chigger-borne disease areas should wear clothing which has been impregnated with the prescribed insect repellent. All clothing except the underwear and the socks should be treated. Furthermore, blankets and sleeping bag covers should be treated whenever bivouac in mite-infested areas is planned. The impregnation instructions printed on the containers should be followed.

(2) Uniforms should be worn with the trouser legs tucked into the boots without blousing rubbers. Shirtsleeves and collars should be buttoned.

(3) The standard insecticide repellent (DEET) should be applied to exposed skin and to all uniform openings including the collar, shirt front, waistband, sleeve cuffs and boot tops.

## **Section IV. LOUSE-BORNE DISEASES**

### **5-10. LICE**

Lice are found all over the world. They thrive during wars and among people suffering economic hardships. Whenever large groups of people are deprived of home, clothing, and bathing facilities, lice usually appear. Although lice are present in the higher altitudes of the Tropics, they are found more commonly in temperate and subarctic areas where people wear heavy clothing in several layers. Diseases transmitted by lice have always been a threat to fighting forces.

a. **Life Cycle.** All lice have three stages of development during their life cycle. These are the egg, the nymph, and the adult. In the nymph stage, the louse looks like a small adult.

b. **Species of Military Importance.** Three species of lice that are of importance are the body louse, the head louse, and the crab louse (figure 5-6). They live on human blood. If they are unable to feed, they will die in a relatively short time. Lice are spread by contact with infested persons or contact with things onto which adult lice or eggs have dropped such as straw, debris, blankets, clothing, or latrine seats.

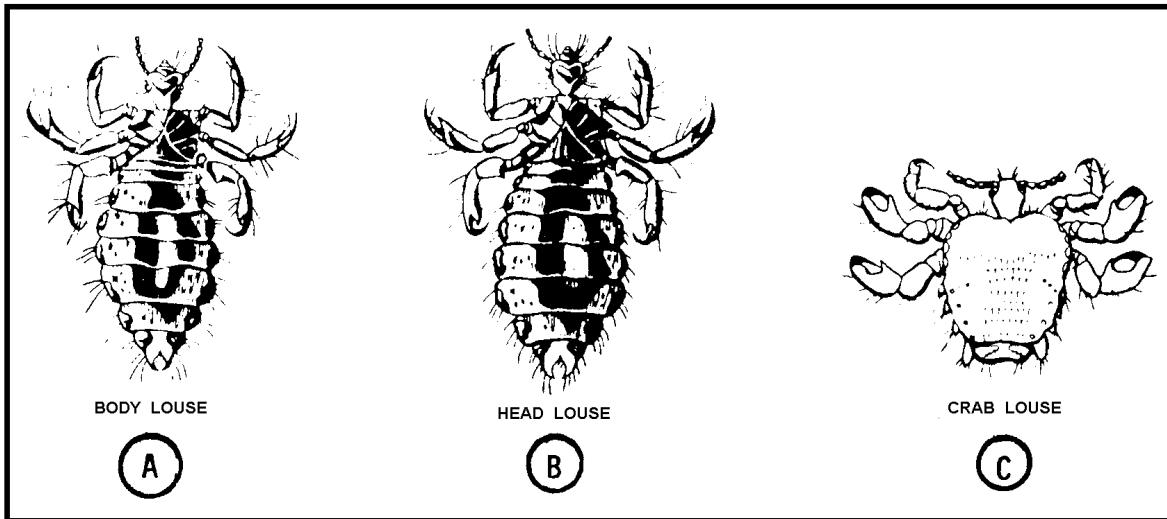


Figure 5-6. Adult lice. A Body louse. B Head louse. C Crab louse.

## 5-11. LOUSE-BORNE DISEASES

The louse-borne diseases are typhus fever (epidemic), relapsing fever, and trench fever. Of these, epidemic typhus is the most important. Trench fever was very common among European armies during World War I, but has greatly declined in incidence since then. Relapsing fever is usually present wherever epidemic typhus occurs. These diseases are spread from man-to-man by lice and occur in epidemics. They are serious infections and are a special threat to armies. A good vaccine against typhus fever is available, but as yet none is available for relapsing fever or trench fever.

a. **Disease Transmission.** Disease is seldom transmitted by the actual bite of the louse. The disease organisms contained in the gut of the louse are excreted with the droppings of the louse when it feeds. Louse bites itch. When the person scratches, the feces containing the disease organisms are rubbed into the tiny skin abrasions. Scratching also may crush the louse and rub the disease organisms contained in its intestines into the wound. This is especially true in the case of relapsing fever.

b. **Body Lice.** Body lice are the vectors of epidemic typhus. They remain in the clothing except when feeding on a person's body. They attach their eggs to the fibers of clothing, especially along the seams, and occasionally to body hair.



c. **Head Lice.** Head lice, which are closely related to body lice, are considered to be of lesser importance in the transmission of disease. They prefer the hairy parts of the body, particularly the head where they attach their eggs to hairs.

d. **Crab Lice.** No disease has definitely been linked to crab lice, but they are annoying pests. They are recognized by their crab-like appearance. They infest the armpits, beard, eyebrows, eyelashes, and particularly the pubic regions.

## 5-12. INSPECTIONS

In every military campaign, provisions to combat lice, especially body lice, must be made in advance. Head and crab lice present individual problems; but from the standpoint of disease, they are of far lesser importance than body lice. When troops are located in areas where the civilian population is infested with lice, they should use louse powder on their clothes routinely as a preventive measure. They should also be warned to stay away from the natives. In spite of precautionary measures, the troops may become infested, particularly if bathing facilities and changes of clothing are not available. Under such conditions, frequent inspections must be made. Lice are not easy to find and may become quite numerous before they are noticed. Whenever a person's skin shows evidence of itching or of insect bites, he should carefully examine his clothes for lice--especially at the seams where eggs and young lice are most likely to be found. When one infested person is found, all other personnel in that particular unit should also be examined.

## 5-13. UNIT DELOUSING PROCEDURES

If inspection shows that five percent or more of the unit personnel are infested with lice, the entire unit should be dusted using mass delousing procedures. The field sanitation team should supervise the delousing procedure.

a. **Duster.** For unit delousing, insecticide powder is applied with a hand duster. Approximately two ounces of insecticide powder will be required for each person to be dusted. The powder compartment of the hand duster is filled about three-fourths full of louse powder. Before beginning the dusting process, the operator should test the delivery of the powder in the open and adjust the flow as necessary to get a heavy cloud of powder from the outlet tube.

b. **Personal Dusting Procedures.** The dusting is done without having the troops remove their clothing and in such a manner that the inside of garments next to the body as well as the body itself is covered with powder. An operator doing this work for the first time should check the results by examining the skin and garments of the first few men dusted. If the dusting process is done properly, powder should cover the underwear entirely and should be visible on the body hairs of the chest, back, armpits, crotch, and thighs. Since body lice are most often found in the seams of clothing, particular attention must be given to the neck, armpits, waist, shirttail, and crotch of clothing.

The men loosen their collars, ties, and belts and then stand or sit as instructed with their hats in their hands. The procedure described below and illustrated in figure 5-7 should be followed. The operator may remain in one position and have the subject turn as required or the operator may move around the subject. At least two full, even strokes of the plunger are required each time the hand duster is pointed in different directions.

(1) Head. First, dust the subject's head. Have the person rub the powder into his hair until it is whitened. Then dust his hat.

(2) Right arm. Have the subject stretch his right arm out to the side at shoulder height, insert the nozzle of the duster into the sleeve next to the skin, and direct the flow of powder toward the armpit. Hold the trigger on the duster down until powder is seen coming from the loosened neck of the shirt. The subject's face should be turned away from the side being dusted.

(3) Left arm. Dust the left arm using the same procedures as were used for the right arm.

(4) Neck. Insert the nozzle inside the shirt collar at the back next to the skin. Blow powder toward the right side, toward the waistline, and then toward the left side. Be sure that some powder is dusted on the collar where lice are likely to hide. This can be done most effectively with the operator standing in front of the subject and the subject resting his chin on his chest.

(5) Chest. Insert the nozzle inside the shirt collar at the front next to the skin. Blow powder toward the right armpit, toward the waistline, and then toward the left armpit. The subject should lean forward with his head tipped backward.

(6) Groin and legs. With the subject standing, insert the nozzle inside the top of his loosened drawers at front next to the skin. Blow powder toward the right leg, toward the crotch, and then toward the left leg.

(7) Buttocks and legs. Insert the nozzle inside the top of the loosened drawers at the back next to the skin. Blow powder toward the right leg, toward the buttocks, and then toward the left leg.

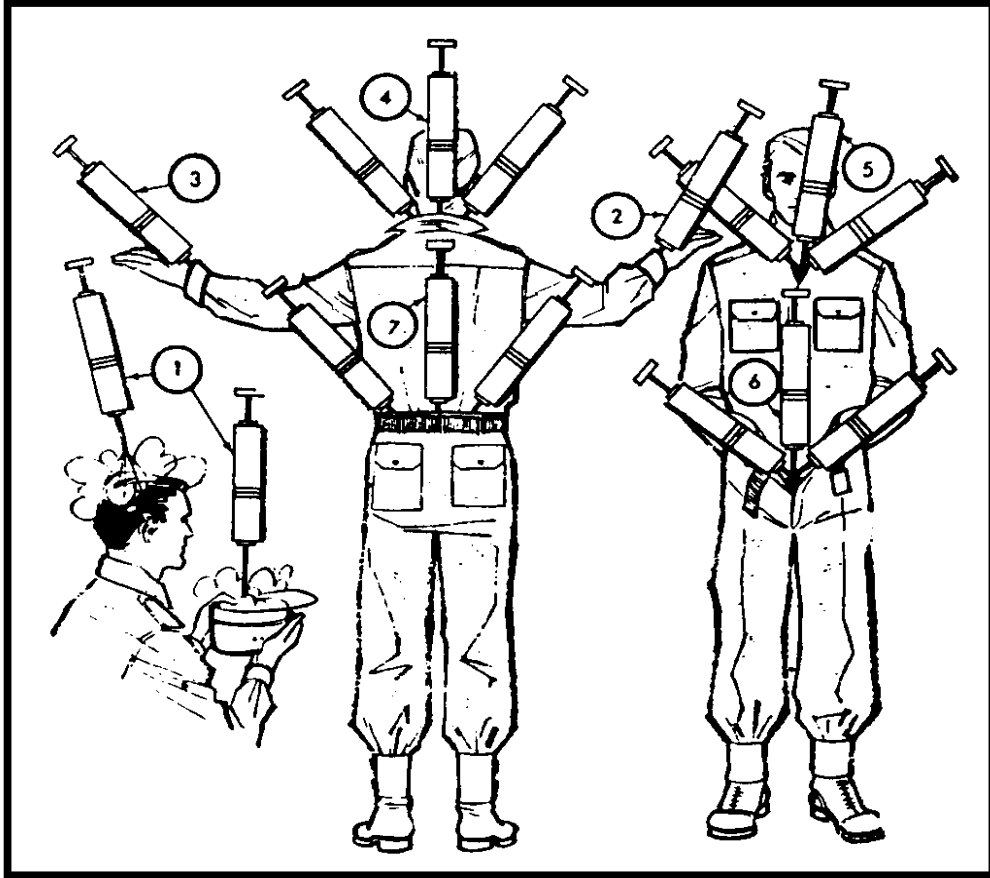


Figure 5-7. Delousing procedure.

## Section V. FLEA-BORNE DISEASES

### 5-14. FLEAS

Fleas are medically important because they produce irritating bites and transmit diseases to man. The fleas that attack man live chiefly on cats, dogs, and rodents. When man lives and works in close association with these animals, conditions are ideal for the occurrence of flea-borne diseases. Although fleas have certain host preferences, they will transfer to and feed on different animals, including man.

a. **Life Cycle.** Fleas go through four stages of development--egg, larva, pupa, and adult (fig 5-8).

b. **Adult Fleas.** The adult fleas are wingless and their bodies are flat on the sides. They have strong, spiny legs that enable them to move rapidly among the hairs of the host and to jump several inches. Both male and female fleas have mouthparts used for piercing the skin and sucking blood from the host.

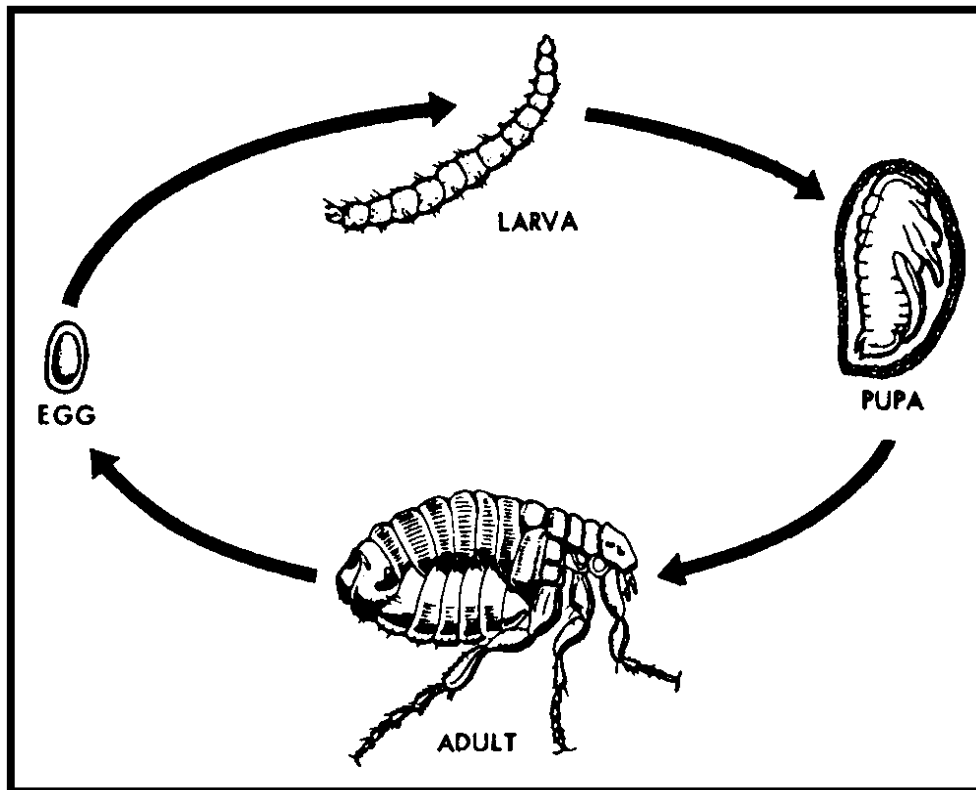


Figure 5-8. Life cycle of the flea.

### 5-15. FLEA-BORNE DISEASES

Fleas that live on rodents are responsible for the transmission of plague and endemic (murine) typhus. Rodents, especially rats and ground squirrels, are reservoirs for these diseases. Fleas become infected with plague organisms when they feed on a rodent that has plague. Plague is then transmitted to man through the bite of the infected flea. Endemic typhus is transmitted when flea feces or crushed fleas are scratched into the skin. This can happen when a person scratches a fleabite.

### 5-16. FLEA CONTROL

Fleas are controlled by applying insecticides to the animal hosts and to the infested area.

a. **Dusting of Animal Hosts.** Except for cats, rabbits, and other animals that clean themselves by licking, lindane powder is the insecticide ordinarily used to control fleas on animals. Animals that lick themselves should be dusted with pyrethrum powder (not a standard insecticide). Merely dusting the animals, however, will not control the fleas. Flea eggs and larvae are in the debris about the areas where the animals rest. Unless these areas are properly treated, reinfestations will take place.

## **b. Treatment of Infected Areas.**

(1) In the treatment of areas infested with fleas and flea larvae (such as rodent nests, burrows, and runways and places where other animals rest), an approved insecticide dust should be applied with a head duster. Should a plague epidemic occur, the dusting operations to kill the fleas must always be accomplished before the rat-poisoning operations (paragraph 5-24) are started; otherwise, the fleas will leave the dead rodents and attack humans.

(2) When rats or other flea-infested animals enter buildings, the fleas may leave the host and infest the cracks and crevices in the floors. These fleas may deposit eggs that hatch into larvae that continue to live and develop in the cracks and crevices of the floor. Good cleaning practices will do much to eliminate or prevent such infestations. If necessary, insecticide dust or spray should be applied.

**c. Individual Protective Measures.** In flea-infested areas, clothing--particularly the trouser legs--should be impregnated with insect repellent. If insect repellent is not available, lindane dust should be applied to the boots, socks, and lower parts of the trouser legs. Insect repellent (DEET) should also be applied to the hands and other exposed portions of the body. The sleeves should be kept rolled down and the trouser legs should be kept tucked into the boots.

## **Section VI. MISCELLANEOUS ARTHROPOD-BORNE DISEASES**

### **5-17. HOUSEFLIES**

Houseflies are found all over the world, but they are most abundant in warm climates. Houseflies, which comprise the majority of all flies found around field dining facilities, are the most important of the nonbiting species in the transmission of diseases.

**a. Fly-Borne Diseases.** The medical history of past wars indicates that the health of troops has been seriously affected by flies. They carry the organisms that cause dysentery and may carry those which cause cholera, typhoid, and other diseases. In the Tropics, various skin and eye diseases are spread by flies.

**b. Method of Disease Transmission.** Flies transmit disease organisms on the tiny hairs of their bodies and feet and in their feces and vomitus. They may bring the disease organisms directly from manure, garbage, and human feces to food and water.

**c. Life Cycle.** The common housefly goes through four stages during the life cycle--egg, larva (maggot), pupa, and adult (figure 5-9). Houseflies breed in manure, human waste, and decaying vegetable or other organic matter.

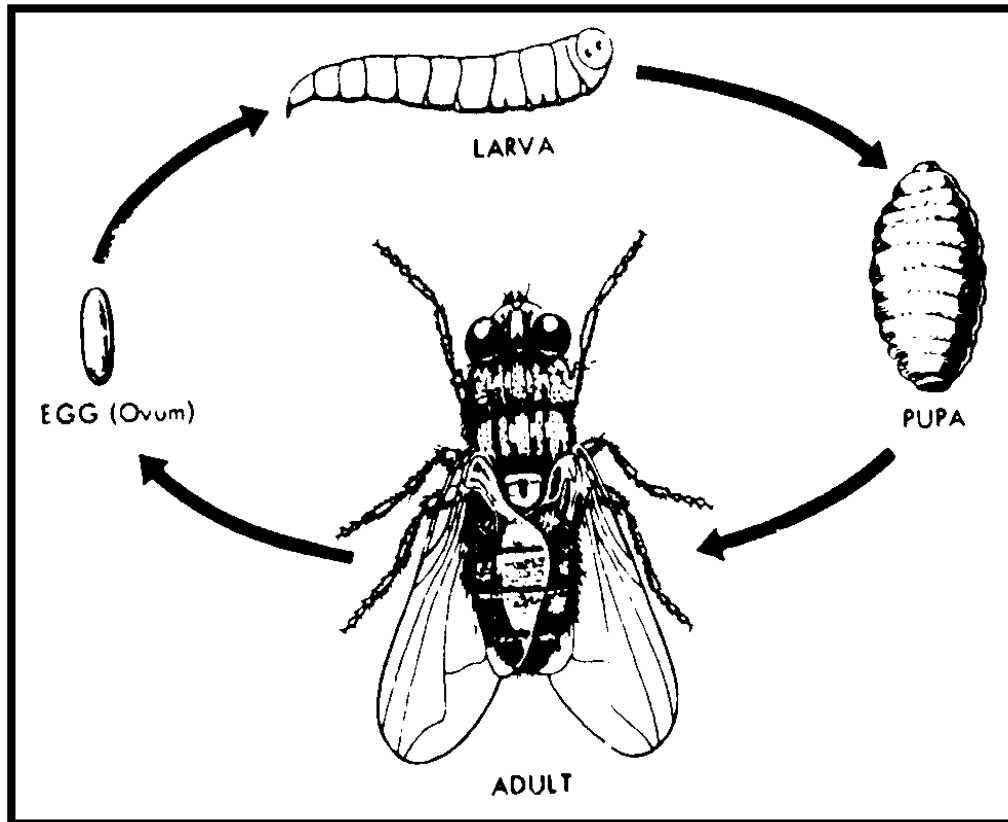


Figure 5-9. Life cycle of the common housefly.

d. **Control Measures.** Flies may be controlled through proper sanitation that eliminates their breeding places, by the screening of living quarters, and by the use of chemicals to kill both adults and larvae.

(1) Control of breeding places. The elimination of breeding sites through proper sanitation is the most effective fly control measure. This requires that all human waste, animal manure, and garbage be covered, disposed of, or treated.

(2) Protection of food against infestation. All food-handling places should be properly screened to protect food against infestation by flies. The screens should be constructed of 18-mesh wire to bar mosquitoes as well as flies. Food-handling places should also be equipped with self-closing doors that fit snugly and open outward.

(3) Chemical control. While the use of chemicals is an important aid to fly control, it should never be adopted as a substitute for sanitation. In places where sanitation is difficult, chemicals may be used to control fly breeding or to prevent new adults from leaving their breeding places.

(a) Space spray. Resmethrin insecticide supplied in low-pressure, 12-ounce dispensers may be used to kill flies quickly. When correctly applied, it is very effective. Close the windows and doors before spraying the insecticide and keep them

closed for 30 to 60 minutes after spraying. In dining facilities, spray at the rate of five seconds per 1,000 cubic feet. Spraying should be done 30 minutes to one hour before serving a meal. This spray does not have sufficient strength to deposit an effective residue to toxic materials; it should never be applied as a residual spray.

(b) **Residual spray.** An approved residual insecticide may be used as a residual spray for the control of adult flies. Ordinarily, flies must be exposed to this residue for one-half to four hours before they die. Apply the spray to areas where flies usually rest (ceilings, corners, table legs, and fixtures inside billets and messes) and to outside doors, screens, and porches. Since fly larvae are usually below the surface of breeding media, it is difficult to reach them with chemicals. The most effective way to control fly larvae is to destroy or remove the material in which they are breeding.

(c) **Fly baits.** Houseflies that have developed resistance to standard insecticides can be controlled by using bait containing an organic phosphorous insecticide. Since some of the organic phosphorous insecticides are highly toxic to humans, only approved formulations are to be used. The bait, which usually consists of cornmeal or sugar and malathion, is prepared by trained personnel and furnished to the unit. It is sprinkled at the rate of an ounce per 300 square feet at locations where flies congregate.

(4) **Swatting.** Swatting is an excellent method of destroying flies that have entered a screened facility. If the shades are drawn on most of the windows, flies will congregate near the light of the unshaded windows where they can be swatted quickly. No dining facility or kitchen should be without several conveniently placed fly swatters.

## **5-18. SAND FLIES**

Sand flies are hairy gnats. They resemble small mosquitoes; but their short, hopping flights are unlike those of mosquitoes. Sand flies are uncommon in most parts of the US but are common in South America, Africa, Asia, and many other warm parts of the world.

a. **Life Cycle.** Sand flies pass through the stages of egg, larva, pupa, and adult in their life cycle (figure 5-10). They breed in damp dark places--caves, crevices, stone embankments, crumbling ruins, earth fissures, and stony rubble.

b. **Diseases.** Sand flies transmit sand fly fever, a disease present in the coastal regions of the Mediterranean, South China, India, and Ceylon. They may also transmit a form of Oriental sore known as leishmaniasis. The bites of sand flies are painful and may result in marked irritation.

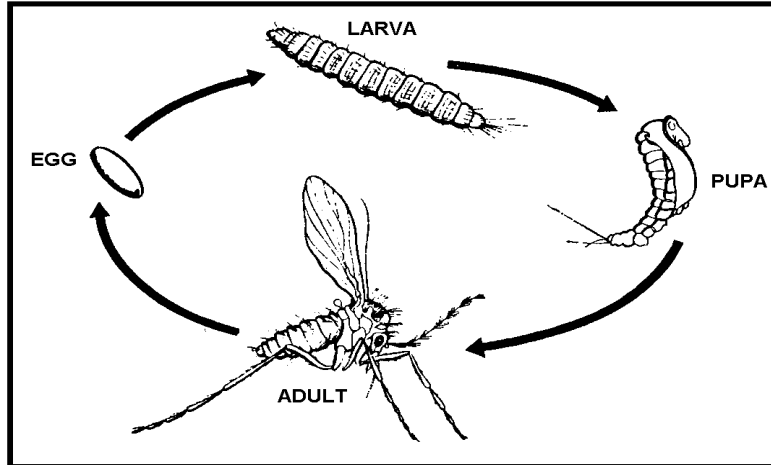


Figure 5-10. Life cycle of the sand fly.

c. **Control Methods.** Sand flies are very sensitive to residual insecticides. In areas where there has been extensive residual spraying against mosquitoes for the control of malaria, sand flies will probably have been eliminated. Their habit of frequenting only the lower floor of buildings can sometimes be used to advantage by moving personnel to upper floor levels. Insect repellents also give protection against attacks by these pests.

### 5-19. BLACK FLIES

Black flies (figure 5-11) are also called buffalo gnats. They are one to five millimeters in length and are particularly abundant in the north temperate and subarctic zones. They often appear in great swarms during the late spring and early summer in hilly sections where swiftly flowing streams provide well-aerated water for larval development.

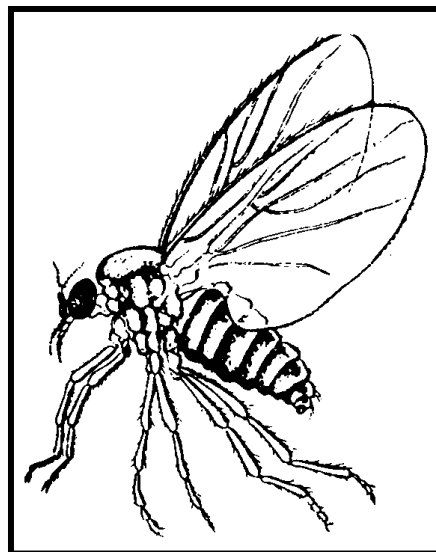


Figure 5-11. Adult black fly.



a. **Life Cycle.** Black flies pass through the stages of egg, larva, pupa, and adult in their life cycle.

b. **Diseases.** The bite of a black fly results in extreme pain, intense itching, and local swelling with occasional severe complications. The most important disease transmitted by black flies is onchocerciasis (river blindness). Animals often die from the bites of these flies.

c. **Control Methods.**

(1) Control of breeding sites. The control of black flies is aimed at the control of breeding sites through sanitation and by spraying with an approved residual insecticide.

(2) Control of adult black flies. Although black flies are larger than sand flies, they are small enough to enter ordinary 18-mesh screen. Painting the screens with a residual insecticide usually keeps black flies out. All of the insecticides used to control mosquitoes will also control black flies. Application of insect repellent (DEET) to the exposed skin will repel black flies for several hours.

## 5-20. KISSING BUGS

Reduviid ("kissing") bugs (figure 5-12) transmit Chagas' disease. This disease has a high mortality rate in Central and South America, especially in Brazil and Argentina. These insects transmit the disease from animals such as armadillos, cats, bats, foxes, and guinea pigs to man.

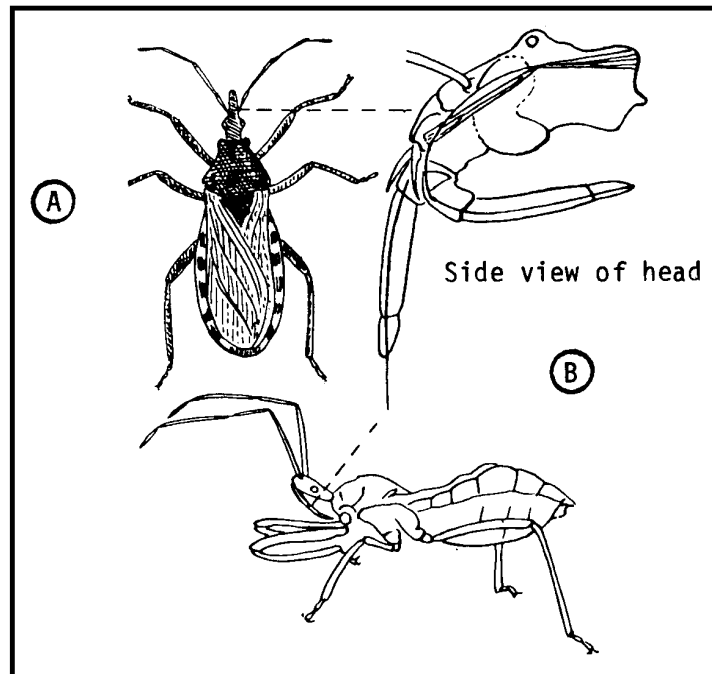


Figure 5-12. Kissing bugs. A Top view. B Side view.

a. **Habits.** Kissing bugs commonly infest houses, hiding in crevices or sites that are dark, obscure, and near sources of blood. Domestic types are usually more active at night.

b. **Control Methods.** Spraying of sleeping quarters with an approved residual insecticide is effectively against infestation. Removing litter used by bugs and rodents for harborage is also a helpful control method.

## Section VII. RODENT-BORNE DISEASES

### 5-21. RODENTS

The term "rodent" refers to any one of several animals including rats, mice, squirrels, marmots, gophers, beavers, porcupines, and ground hogs. Rodents discussed in this section, however, are limited to the domestic rats such as shown in figure 5-13. Rats contaminate and destroy food supplies, damage buildings, cause fires by gnawing the insulation of electric wires and conduits, and function as reservoirs of diseases. Rodents are nocturnal and ordinarily do not move about during the day. They move in narrow runs along buildings, walls, pipes, and overhead beams. Rodents gnaw through materials to obtain food and shelter. Wood is not a barrier as they have very sharp teeth that cut through it quickly. They are spoilers. They will take one bite from many potatoes instead of eating one, sample every bag of flour, and eat from every piece of meat, thus contaminating all of them. These pests damage far more food than they eat.

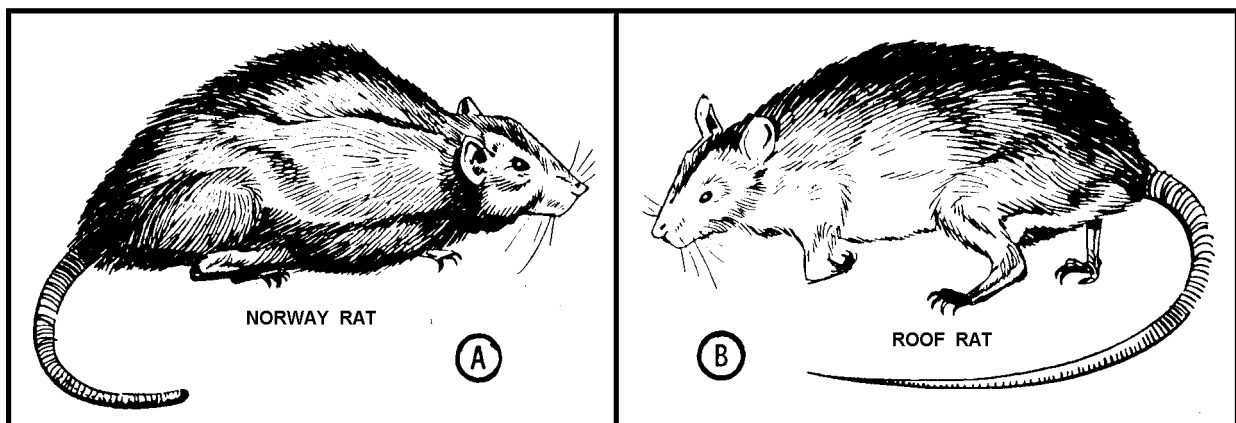


Figure 5-13. Two domestic rodents. A Norway rat. B Roof rat.

### 5-22. RODENT-BORNE DISEASES

Rodents are carriers of several human diseases. Most of these diseases are transmitted through an insect vector, but a few can also be transmitted by direct contact.

a. **Plague.** Plague ranks first in importance among rodent-borne diseases. It is found worldwide. Primarily a disease of rats and of other wild rodents, plague may be transmitted to man by the bite or the feces of a flea that has previously fed on an infected rodent.

b. **Endemic Typhus.** Endemic or murine typhus is transmitted to man by the feces of rat fleas. This disease is usually milder than the epidemic typhus transmitted from man-to-man by the body louse.

c. **Leptospirosis.** Leptospirosis is caused by contact with the urine or feces of an infected rat or other animal.

d. **Rocky Mountain Spotted Fever.** Rodents are reservoirs of this disease. The disease is transmitted to man by infected ticks.

e. **Scrub Typhus.** Scrub typhus, also called tsutsugamushi fever or Japanese river fever, is transmitted by a larval mite that is normally parasitic on rodents.

f. **Tularemia.** Tularemia is a serious disease that is widely distributed throughout the United States. It may be contracted from the handling of infected rabbits or other rodents or from the bite of ticks or deer flies.

g. **Salmonellosis.** Salmonellosis is one form of food poisoning. Although the major sources of such poisoning are food handlers and poultry products, the disease organisms may come from the feces and urine of infected rats and mice.

### **5-23. ENVIRONMENTAL RODENT CONTROL**

The most effective rodent control is environmental control. This may be thought of as a preventive maintenance program. The basic principle in environmental control is to make the environment unfavorable to the rodent by denying it basic biological needs such as food, water, and shelter.

a. **Food.** Rats obtain food from pet dishes, improperly closed food containers, unprotected food in storage, improperly closed garbage cans, and many other sources. It is in this area that the most rewarding steps in rodent control may be taken. Food service personnel should properly store all food items. Open packages should be placed in tightly covered metal containers. Soldiers should be required to store all personal food in tightly covered containers such as cake tins. Garbage and rubbish should be disposed of frequently and properly. Good sanitation is probably the most important aspect of an environmental control program.

b. **Water.** Rats obtain water from many sources such as pet dishes, leaky faucets, stoppered sinks, open rain barrels, and ditches. All of these sources should be eliminated. Outdoor containers that must remain open should be covered with screens to deny access to rats.

c. **Shelter.** Any rubbish, crack, crevice, or similar object that will provide seclusion and protection from the elements will serve as harborage for rats. These shelters should be removed or sealed so that the rats cannot gain access.

## 5-24. RODENT CONTROL PROGRAMS

Although environmental control is the most effective means of rodent control on a continuing basis, more aggressive control programs are sometimes necessary. For example, a commander may find that an area that has just been occupied is already infested with rodents, a rodent-borne disease outbreak may necessitate an aggressive control program, or adverse weather conditions may drive rodents to seek human habitation for food and shelter. A complete rodent control program consists of five distinct steps in a deliberate sequence.

### a. Rodent Surveys.

(1) Observations. Surveys for signs of rodents should be made by the field sanitation team regularly in order to detect the presence of rodents early. The following signs indicate not only the presence of rodents but also the type of rodents, the approximate number, and their location. Figure 5-14 provides a guide for estimating the extent of rodent infestation.

Rat Signs Observed	Light (1-20)	Medium (21-50)	Heavy (over 50)
Tracks	Few or moderate in number; usually all of one size.	Moderate to many; usually of two or more distinct sizes.	Many; two or more sizes; runways in duty areas usually slick and not dusty.
Fresh Droppings	None or few groups observed; generally all of the same size.	Some always observable in two to eight areas; usually two distinct sizes.	Many; usually of several sizes; small to large and in at least six locations.
Active Runs	None or few and relatively indistinct.	Several distinct; one or more, indicating heavy travel.	Many; more than one heavily traveled run.
Fresh Gnawing	None to few nightly.	Usually several instances nightly.	Many instances nightly.
Live Rats Seen	None by day except on cleanup and harborage removal.	None to two by day unless harborage is opened up.	Often one or more seen by quiet, close observation, even in daytime.

Figure 5-14. Table for estimating the number of rats present.

(a) **Sounds.** Rodents can be heard scurrying about at night or during the day when the part of the building that they inhabit is dark. Overhead scurrying is a reasonably sure sign of roof rats.

(b) **Burrows in the ground.** Burrows may be found inside a building with dirt floors, outside with the tunnel leading inside a building, around rubbish or woodpiles, and around stacks of supplies stored outside. The presence of burrows is a sign of Norway rats.

(c) **Holes.** Rats gnaw holes to gain entrance for food and shelter.

(d) **Smudges.** Smudges along beams, pipes, or floors close to walls indicate the presence of rat paths (runs).

(e) **Droppings.** Rats drop pellet-like excreta along the runs or on the floor under the runs.

(f) **Tracks.** Rat tracks are visible in dirt and insecticide dust.

(g) **Dead rodents.** In the absence of chemical and mechanical control measures, dead rodents may indicate the presence of plague.

(2) **Traps.** While the evidences of infestations enumerated above are important guides to making a survey, it is also desirable to set a number of traps in order to collect specimens and confirm the results of the inspection. Live traps are preferable to traps that kill the rodents. This permits submitting live specimens, along with their ectoparasites, to an entomology laboratory for examination. A complete rodent survey includes a survey of the ectoparasites (fleas, mites, ticks, and so forth) that live on the particular rodent population.

**b. Ectoparasite Control.** The more serious rodent-borne diseases are transmitted by arthropods rather than the rodents themselves. Therefore, it is very important that measures be taken to prevent parasites on rodents that are trapped or poisoned from leaving the dead animal and seeking a human host. Ectoparasite control consists of applying an approved residual insecticide to all known rodent harborages (shelters), burrows, runs, and similar areas. In addition, an insecticide dust should be sprinkled around all traps and poison bait stations. Ectoparasite control should normally precede rodent extermination operations by several days.

**c. Rodent Extermination.**

(1) **Mechanical control.** Mechanical control is achieved through the use of traps. It is the method of choice in any area where food is handled or stored because of the hazards created in using a poisonous chemical around food. A large number of traps should be used since a 10-percent catch is considered good. Various types of

mechanical traps are available. The type used most frequently is the snap trap that kills the rodent. The following procedure should be used in preparation and placement of the traps.

(a) Bait the traps with the food that has attracted the particular rodents present in the area. Good baits are oily foods such as bacon and peanut butter, cereals such as oatmeal and cream of wheat, and fresh fruits and vegetables such as tomatoes do not make good bait.

(b) Place the traps along the runs created by the rodents or at the entrance of the burrows and harborages. Position the traps so that the rodents can approach them from both directions.

(c) Sprinkle a light dusting of an approved insecticide powder around each trap for the purpose of killing the parasites as they leave the dead rodent. Otherwise, parasites that transmit diseases will leave the dead rodent and find a new host, perhaps a soldier.

(2) Chemical control. Chemical control achieved through the use of poisonous bait stations may be the method of choice except in the areas where food is handled or stored. Unit personnel, including the field sanitation team, must never use poisonous bait in food areas. If this becomes necessary, the work will be performed by personnel who have had specialized training. Several doses and eight or nine days are required for this bait to kill a rodent. The following procedure should be used in the preparation and placement of poisonous bait stations.

(a) Obtain the necessary number of rodent bait containers of the disposable type. If these containers are not available, make bait boxes. The most effective bait box is made by nailing together four boards that are five inches wide and 18 inches long, thus forming a rectangular structure with the ends open. The rodent bait containers or boxes make the poison accessible to rodents but inaccessible to most other domestic animals.

(b) Place four to eight ounces of bait inside each container.

(c) Position the bait stations along the runs or at the entrance of burrows and harborages with both ends accessible to the rodents.

(d) Sprinkle a light dusting of insecticide powder around each bait station so that the rodent will get the insecticide on its fur. The insecticide will kill the disease-transmitting parasites on the rodent and in the nest to which the rodent returns.

d. **Rat-proofing**. Rat-proofing consists of constructing buildings or altering their construction so that rats cannot enter. It also includes eliminating a potential shelter for them within the building. It is obvious that this is a difficult task in the field since buildings are normally improvised. Tents cannot be effectively rat-proofed; therefore, maximum effort must be placed on environmental control.

e. **Environmental Control.** Environmental control (paragraph 5-23) is both the first and last step in a continuous cycle of rodent control measures. It is employed as a preventive measure against rat infestations. However, should an infestation occur and a control program be necessary, environmental sanitation measures are further tightened as a follow-up for the maintenance of control.

## **5-25. DISPOSAL OF DEAD RODENTS**

All traps and bait stations must be checked early each morning for dead rodents. The following self-protective measures are essential in disposing of the dead rodents.

- a. Apply insect repellent (DEET) to the hands, sleeves, and front of clothing in order to repel any parasites which may attempt to leave the rodents as they are removed from the traps or stations. Do not assume that all parasites have already left the rodents or have been killed in the insecticide dust.
- b. Using long-handled tongs or a shovel, pick up the rodents and place them in a plastic bag or a metal container that has a tightly fitted lid.
- c. Burn or bury the dead rodents, depending upon the local situation.

**Continue with Exercises**

## EXERCISES, LESSON 5

**INSTRUCTIONS:** The following exercises are to be answered by circling the letter of the response that best answers the question or best completes the incomplete statement.

After you have completed all of the lesson exercises, turn to "Solutions to Exercises" at the end of the lesson and check your answers.

1. Of the following, which is the most important in spreading serious communicable diseases?
  - a. Body lice.
  - b. Crab lice.
  - c. Head lice.
  
2. One soldier states that your unit does not have to worry about mosquitoes since mosquitoes only live in tropical and subtropical climates. Is the soldier's information correct?
  - a. Yes.
  - b. No.
  
3. Of the following, which is not a true insect?
  - a. Housefly.
  - b. Kissing bugs.
  - c. Mosquito.
  - d. Tick.



4. As a member of the sanitation team, you have examined many areas of where mosquitoes breed. Almost all of the mosquito larvae you saw were lying parallel to the surface of the water and just under the water's surface. These mosquitoes are probably \_\_\_\_\_ mosquitoes.
- a. Aedes.
  - b. Anopheles.
  - c. Culex.
  - d. Plague.
5. In delousing procedures, a person's body is dusted in what general order?
- a. Head, arms and upper trunk, lower trunk and legs.
  - b. Lower trunk and legs, arms and upper trunk, head.
  - c. Upper trunk and arms, lower trunk and legs, head.
  - d. Arms, legs, lower trunk, upper trunk.
6. Rocky Mountain spotted fever is transmitted by:
- a. Mosquitoes.
  - b. Fleas.
  - c. Ticks.
  - d. Flies.
  - e. Mites.

7. You are baiting rat traps. Which one of the following would you be least likely to use as a bait.
- a. Bacon.
  - b. Carrots.
  - c. Peanut butter.
  - d. Tomatoes.
8. The following have been observed during a typical day: rat droppings in four locations, two distinct rat runs, and several rat tracks (two different size tracks). What would you estimate the number of rats infesting the area to be?
- a. Less than 20.
  - b. Between 20 and 50.
  - c. More than 50.

**Check Your Answers on Next Page**

## **SOLUTIONS TO EXERCISES, LESSON 5**

1. a (paras 5-11b, c, d)
2. b (para 5-1)
3. d (para 5-4)
4. b (para 5-1c; figure 5-2)
5. a (para 5-13b; figure 5-7)
6. c (para 5-5a)
7. d (para 5-24c(1) (a))
8. b (figure 5-14)

**End of Lesson 5**